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OIL WEEKLY

AUGUST 1, 1955

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING,
PRODUCING OPERATIONS AND MANAGEMENT

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- **Modernizing obsolete pumping equipment will reduce operating costs . . . Production Section**
- **Life in the Monte is mild . . . a Camp City profile of Las Mercedes, Venezuela . . . International Section**

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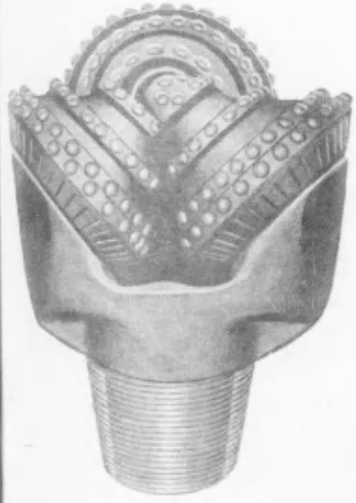

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Select Cement to Fit the Job!

Vol. 141, No. 2

August 1, 1955

WORLD OIL

Established 1916 as The OIL WEEKLY®

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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **The petroleum industry,** like U. S. business in general, is making capital expenditures at record levels, thereby continuing to increase its gross investment. Gross assets of petroleum industry in U. S. are now about $49 billion and due to pass $51 billion by end of the year. Capital expenditures amounted to more than $5 billion in 1954 and are running at similar or higher levels this year. For details, see **Page 42. Oil Industry Investment Approaching $50 Billion** ... **L. J. Logan**

Turn the Page ➧

THIS MONTH . . .

☐ **Recent increases in wages and costs** of materials will appreciably affect oil and gas industries, drilling contractors, and equipment manufacturers. Operating costs will be increased substantially and it remains to be seen if higher costs can be passed on to consumers. A nationwide check by WORLD OIL staff members shows general agreement that business operating costs will be higher. The survey also reveals general uncertainty as to whether the extra costs can be retrieved in selling prices of products involved. For a special report on this timely topic, read . . . **How Will Wage and Price Hikes Affect the Industry?** . . . . **Page 44**

☐ **What is good for the employes** is good for the company and its stockholders in the case of General Petroleum Corporation's health program for its workers. Periodic physical examinations for 6000 employes have yielded significant benefits to both the employes and employer. The advantages more than offset the costs. For the employes, the program means better health and increased safety. The company has benefited through decreased absenteeism and fewer accidents. See **Page 49. Health Programs Aid Employes and Employer** . . . . **Dr. E. P. Luongo.**

☐ **Meetings can be profitable.** Association conventions, committee meetings, and company conferences cost American industry large sums of money each year. To be justified they should pay off in worthwhile benefits to the concerns footing the bills. These benefits come only through proper planning, purposeful attendance, and constructive post-meeting action. For how this can be done, turn to **Page 54. How to Get Most Out of Your Meetings** . . . . . **Irving Ladimer**

☐ **The U. S. continues to lose ground** in world tanker shipping. She still was the leading country in ownership of tankers at the end of 1954 but the United Kingdom was second. Upon completion of tankers now under construction or on order, Britain will pull alongside the U. S. Construction in U.S. continues to lag while the British proceed with an active program. In an effort to compete with low operating costs of foreign tankers, U. S. owners order bigger, faster, ultra-efficient supertankers. For an analysis of the world tanker fleets, read . . . **Britain to Pass U. S. in Tankers** . . . . . **Page 60**

☐ **The shortage of engineers** is troubling oil and gas companies like most other U. S. concerns with highly technical operations. The need is 2 to 3 times as great as the current crop coming out of U. S. colleges. For a quick look at the situation, see . . . **What Happened to the Engineers?** . . . . . **Page 66**

EXPLORATION ARTICLES

☐ **Isopachous maps** involving great thickness of rocks have been used successfully to reveal structural movements in the Rocky Mountain region. The article beginning on **Page 77** explains the technique as applied to milder structural warpings in the Mid-Continent region where rock sequences are thinner and the deformation is of a lower order. **Thickness Maps Can Reveal Mid-Continent Structures** . . . . **Wallace Lee**

☐ **Gamma ray counters** are being used more and more in exploration work by oil companies, independent operators, and consultants. There is little in the literature to help in the prevention of common errors in this survey method. On **Page 84,** you will find an article designed to help in avoiding costly errors and aimed at facilitating the development of this new and useful method. **How to Avoid Costly Errors in Gamma Ray Surveying** . . . . . **Dr. John W. Merritt**

☐ **More accurate evaluations of formations** are possible if field crews obtain samples of freshly circulated mud before running electric logs. Contaminated mud samples make many old logs of doubtful value. It is essential that true drilling mud resistivity be ascertained from a sample taken from the mud flowline before the well stops circulating. For a brief discussion of the proper procedure in mud sampling in connection with electric logs, turn to **Page 92. How Proper Mud Sampling Can Air Exploration.**

DRILLING ARTICLES

☐ **Injection of air into conventional drilling muds** appears to be a practical method of effectively reducing mud density at the bit. This may be helpful when lost circulation conditions are encountered. After making further tests on air injection, Phillips Petroleum Company's Research Division has prepared additional charts which extend the range of applicability and accuracy of earlier ones. These new charts, together with the necessary equations, are presented on **Page 97. Density of Drilling Muds Reduced by Air Injection.** . . . . . **F. H. Poetmann and W. E. Bergman**

☐ **A cross-section of typical mud problems** can be found in the Wilcox Trend . . . lost circulation, sloughing shale, high temperatures, high pressures, and contamination. Here is how these problems are met in this area . . . and could be met in any other region of like size. Turn to **Page 102. The Wilcox Trend . . . A Cross-section of Typical Mud Problems.** . . . . **Dr. George R. Gray and W. C. Kellogg**

☐ **Rig moves don't just happen.** Intricate planning and coordination are essential to the fast and economical completion of a rig move. It's one of the

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most expensive phases of rig operation. Turn to **Page 118** for a review of simple . . . but important . . . steps in planning the rig move. **Rigs on the Move. O. Matheny**

☐ **Transportation in the Williston Basin** is hampered more by state regulatory bodies than the weather. Poor reciprocity privileges and high truck-mile taxes have faced contractors and truckers as they move into North Dakota. For a discussion of trucking regulations in this state, turn to **Page 120. Oil Field Trucking Regulations in North Dakota. . . . . Allan M. Shirley**

PRODUCTION ARTICLES

☐ **Producing offshore oil profitably** depends on the efforts of the production personnel in simplifying, unitizing and otherwise reducing the cost of operations. How Kerr-McGee Oil Industries, Inc., has lowered costs by using caissons for protection of producing wells and anchored floating storage barges in place of platform structures is told in an article beginning on **Page 139. How to Cut Offshore Producing Costs. Grier D. Zimmerman**

☐ **Novel methods of operation** and some new equipment are being used by Sinclair Oil and Gas Company at its Tanner water-flood project in Nowata County, Oklahoma. These are described in an article on **Page 144. Sinclair's Tanner Flood Embodies Unique Features. . . . . Anthony Gibbon**

☐ **Many significant advances** have been made in production equipment during the past year. The outstanding developments are described and discussed in this issue. See **Page 150. New Developments in Production Equipment. . . . . T. H. Fraser**

☐ **Increased production and lower operating costs** have been achieved by Shell Oil Company through replacement of obsolete pumping equipment with automatically-controlled individual electric motor-driven units on 464 wells in southern Oklahoma. Savings in operating costs alone promise to yield 353 percent return on the investment of $900,000. Turn to **Page 156. Modernizing Equipment Cuts Operating Costs. . . . . Frank Poorman**

☐ **The use of two pumping units for one dually-completed well** has met with considerable success for Stanolind Oil and Gas Company in the Velma field of southern Oklahoma. This is an unusual completion, but it works. Two separate tubing strings prevent commingling of the produced fluids. Some special considerations were required in setting the two pumping units over a common wellhead. Turn to **Page 162** for the details. **Two Units Pump a Dually-Completed Well . . . George E. O'Neal.**

John N. Schuelke Is Named World Oil Production Editor

JOHN N. (JACK) SCHUELKE has joined WORLD OIL's editorial staff as Production Editor. Since 1953 Schuelke has been West Texas division field engineer for Security Engineering Company. He has been active in the Permian Basin chapter of API, serving on some of the chapter's study committees. Last fall he presented a paper on casing repair before the API Drilling Practices Committee in Midland, Texas.

John N. Schuelke

Schuelke attended the University of Texas from 1939 to 1941. After four years service in the U. S. Marine Corps during World War II, he returned to the university and was graduated in 1948 with a degree in mechanical engineering.

Following graduation he worked as a production engineer for Magnolia Petroleum Company in West Texas and Oklahoma. This assignment included work on waterflooding, salt water disposal, production equipment, corrosion mitigation, workovers, drilling, and completions. During the four and one half years he was on this job he wrote 23 reports on his findings.

INTERNATIONAL ARTICLES

☐ **Offshore oil operations** depend upon marine transportation to move men and equipment with precision timing. Oil companies operating in Venezuela's Lake Maracaibo have had more than 25 years of experience in boat operations and upkeep. They have solved many of the problems and are working toward the solution of others that are confronting U. S. operators in the Gulf of Mexico and on the Pacific Coast. Read of their experience. **South American "Navy" Tends Maracaibo's Oil. . . . . Page 181**

☐ **A Camp City Profile.** Five hours by car south of Caracas, Venezuela, is The Texas Company's Las Mercedes oil field camp. The houses are pretty. The climate is good. So is the life. Interested? Turn to **Page 186. Life in the Monte Is Mild. . . . . James Joseph**

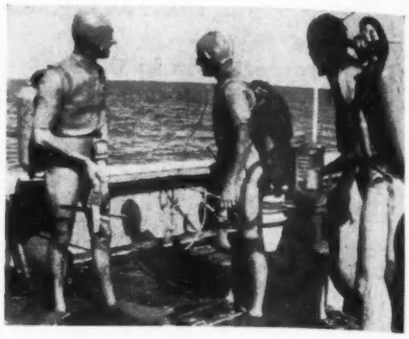
Turn the page for a Quick Look at what's ahead in WORLD OIL . . .

On August 15 . . .

Are you interested in a special issue which covers authoritatively and thoroughly the industry in which you have a definite role . . . which discusses industry factors that have a definite impact on you—daily and in terms of dollars and cents—regardless of your position or locale of operations?

Then you'll find WORLD OIL's August 15 International Outlook Issue a valuable and interesting source of pertinent data about your business.

This year, the International Operations Issue will be expanded to include information which every oil man should have about international operations and their probable effect, especially on U. S. activity. Also included will be a look behind the Iron Curtain. These extras will be in addition to the annual country-by-country summaries reflecting 1954 and 1955 petroleum activities.



Underwater Exploration in Persian Gulf

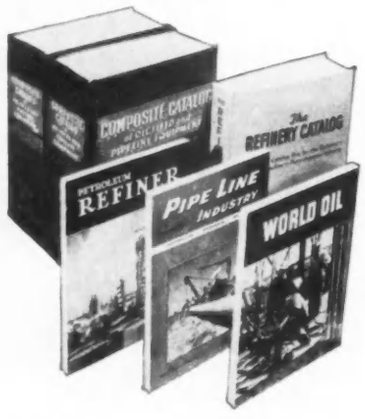
. . . and on September 1

Experimental 3-in-1 Workover Truck

Approximately 2000 wells in the Gulf Coast of Texas and Louisiana have been completed by the so-called "permanent-type" completion technique. WORLD OIL will include a special symposium in the September issue to bring you up to date on this significant development.

T. A. Huber and G. H. Tausch, pioneers of permanent-type completions, will discuss many of the new tools and techniques that permit logging, cementing, perforating, removing sand, production stimulation and other operations without removing the tubing from the hole. Also described will be Humble Oil & Refining Company's new experimental 3-in-1 workover truck, new logging instruments that provide good through-tubing logs, and a new truck for servicing gas lift wells.

Don't miss this symposium on permanent-type well completions in the September issue of your WORLD OIL.



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District Editors: Gilbert M. Wilson, W. W. Wilson Building, Huntington Park, Calif.; Anthony Gibbon, Hunt Building, Tulsa 3, Okla.; Harrison T. Brundage, 250 Park Ave., New York 17, N. Y.

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Indexed by Industrial Arts Index Engineering Index

Looking Ahead . . .

. . . **Governor's signature on bill opening California tidelands** to drilling is bringing quick action. State Commission has already authorized bids on 2640-acre tract off Newport Beach. In past, state's submerged lands could be leased only where there was drainage of state oil pools by nearby private operations. New law, effective September 7, opens most of coastline from Newport Beach, Orange County, to Oceano, San Luis Obispo County.

. . . **August and September imports will be higher** than expected, importers say. August forecast is now 941,433 barrels daily, up 4000 from earlier estimate, and September total will be 947,494, up 10,000. Texas Independent Producers and Royalty Owners Association declares imports for second half of year can average no more than 967,000 barrels per day without exceeding average found by Cabinet Committee to be maximum consistent with national security. IPAA expects imports to average 1,105,000 barrels daily during August and September.

. . . **Announced plans for a 20-inch, 195-mile West Texas crude line** to be built by Pasotex could put damper on agitation for government-subsidized carrier between West Texas and Los Angeles. Significance lies in ease of tying in line with Southern Pacific products line, now under construction between Los Angeles and El Paso. T. S. Petersen, president of California Standard, parent company of Pasotex, revealed plans for line while House Armed Services subcommittee was holding Los Angeles hearing to study advisability of West Texas-California line proposed by L. M. Glasco of Dallas.

. . . **U. S. tanker fleet is losing ground to Britain's,** may soon rank second. Study by Sun Oil Company shows that at end of 1954 U. S. trailed Britain by 95 to 8 in orders for new tankers. Researchers say trend will continue.

. . . **Oils will spark whole stock market** remainder of year, some analysts are saying. Oils offerings are perking up after lagging behind industrials.

. . . **Cost of pipe line connections is causing increasing concern** among producers, especially marginal lease operators. Almost every day some producer finds he can't run his low allowable without trucking oil to refinery or terminal. In Oklahoma, for example, trucks now move more than 20,000 barrels of crude daily. Prices range from 1 cent per barrel per mile, with minimum of 25 cents per barrel, to as high as 50 cents per barrel. Since producer must absorb trucking charge, it is equivalent to reduction in posted price.

. . . **Natural gas lines are earning more,** spending more. Gross revenues are up 13.7 percent for 12-month period ended in April, net income up 8.7 percent. Gas volume bought in April was 501.5 billion feet, up 5.4 percent over same month of 1954.

. . . **Going into river service is a trick tanker** that can move sideways as well as backward and forward. Built in England for Shell, 450-ton ship has new-type propulsion unit which also serves as rudder.

. . . **Oil business will seek aid from Operations Research,** a problem-solving tool, in planning exploration campaigns. Designed for war-time military tactics, Operations Research principles are beginning to filter into business fields. Major revamp in contract organizations will soon occur. Wage and equipment cost increases will arrive ahead of increased contract rates. Cut-throat contractor, nearing brink of financial ruin, will continue ot hold down contract rates as operating overhead increases. Now-delicate balance between overhead and profit has prompted drilling contractors to stack rigs. Picture will become more critical with inevitable increase in operating costs.

. . . **First targets in CIO oil union's impending membership** drive are expected to be units of Jersey Standard, Du Pont. Cash, crack organizers from Walter Reuther's parent CIO will probably bolster OCAW efforts.

XM ACID

Acid additive developed by Dowell helped to increase production from 6 to 480 BOPD—after regular acidizing failed

Dowell addition agents and acidizing techniques give a big boost to your chances of more successful well completions and more profitable production.

For example, here's the case of a well completed in a dolomitic formation. Two successive regular acidizing treatments had raised the well's output from 6 BOPD natural to 30 BOPD. Then the well was acidized by Dowell using XM Acid. As a result, production jumped to 480 BOPD!

These results indicate that in the two regular acidizing treatments, clay and silicate materials were swollen by spent hydrochloric acid and had partially plugged the flow channels. Often in such cases, regular acidizing actually decreases production. However, XM Acid contains a Dowell-developed additive which is designed to control silicate swelling and eliminate such plugging.

For full information about modern acidizing services tailored to your well, call the nearest Dowell office. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. H-13.

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Oil Need Not Fear Atomic Energy

Atomic energy can be expected to experience a fairly rapid rate of growth in the years ahead. Electric power from nuclear reactors will be available in the U. S. within a few years. Other installations like the one under construction by Duquesne Power Company at Pittsburgh, Penn., will be built. It has been predicted that one out of every three new electric generating plants will be of the nuclear type in the future.

It also seems probable that atomic power for ships may begin to find practical application within a few years. Other uses also can be expected to be developed.

However, the petroleum industry need not become alarmed over these prospects. The consumption of oil can be expected to continue to expand at very substantial rates as far ahead as we can see.

•

There is going to be such a tremendous increase in total energy requirements of the world that there will be plenty of room for atomic power and all other power sources. A continued big-scale growth in petroleum consumption seems assured.

M. J. Rathbone, president, Standard Oil Company (New Jersey), has predicted that energy consumption in the U. S. will grow by 63 percent by 1975. After allowing for a fairly rapid nuclear power rate of growth, Rathbone foresaw the atom's contribution to U. S. over-all energy needs in 1975 as amounting to only 1½% of the total power consumption of the country.

Nuclear fuels probably will find their greatest use in the electric power generation field. Other potential energy sources, such as solar energy, heat pumps, etc., will not be contributing more than a negligible amount of the total U. S. energy picture. Hydro-electric power will have only moderate expansion. Coal may recover a little of its lost ground. Natural gas in another five years or so will not be growing so rapidly, as reserves are depleted and prices tend to rise. This leaves oil to supply much of the increased energy that will be consumed in the U. S. Old uses for oil are still growing at rapid rates. In addition, new uses are constantly being developed.

Thus, it is indicated that consumption of oil in the U. S. is to continue to grow in the future. Rathbone forecast that the U. S. would be consuming 13⅓ million barrels of oil by 1975. Some others have predicted as much as 15 million barrels. These figures compare with present consumption of a little over 8 million barrels daily.

Equally impressive gains in oil consumption can be expected outside the U. S., Western Europe and Latin America are turning more and more to oil as a source of energy. Population in these areas is growing faster than ever before. At the same time, per capita consumption is increasing sharply as nations in these areas become more industrialized and mechanized. Rathbone has predicted that consumption of Western Europe and Latin America will reach 7¾ million barrels daily in 1975. Current consumption is only 3⅓ million barrels per day.

•

These conditions indicate that further vigorous expansion will take place in the consumption of oil during the next 20 years. Petroleum need not fear the entrance of atomic energy. Power requirements of the world will expand so greatly during the next 20 years that there will be plenty of room for all forms of energy.

Warren L. Baker

Oil Industry Investment Approaching $50 Billion

Oil industry, like U. S. business in general, is making capital expenditures at record levels.

Gross assets of petroleum industry at mid-year exceeded $49 billion and will go over $51 billion by end of year.

Oil now third largest U. S. industry on basis of investment employed. Capital expenditures at '54 levels when they totaled over $5 billion.

By L. J. LOGAN, World Oil Staff

The gross investment of the petroleum industry in the U. S. will be increased by more than $4 billion this year and will reach a total of over $51 billion at the end of the year. At the middle of this year the investment exceeded $49 billion.

The investment in the industry has been growing constantly since World War II. It has been increasing around $4 billion annually in recent years. The increases have been largely in the form of additions to fixed assets, comprising property, plant, and equipment. The expansion has included the drilling of new wells and construction of refinery units, pipe lines, service stations, and other facilities.

Petroleum has been for several years the third largest industry of the U. S. in terms of investment or assets. It now is narrowing the short lead held by the public utilities, which are in No. 2 position.

Agriculture employs an investment of over $165 billion, far outranking any other industry. The public utilities were estimated in 1953 to have an investment of about $52 billion, and the total subsequently has been increased substantially, as there has been extensive further expansion in that field. The railroads constitute the fourth largest U. S. industry, with gross investment of about $34 billion. After World War II the petroleum industry went ahead of the railroads and replaced them as the No. 3 industry.

The U. S. petroleum industry investment of over $51 billion at the end of this year will be almost three times as great as that of approximately $17.7 billion at the end of World War II. In the 10 postwar years, 1946-1955, expenditures for property, plant, and equipment in the U. S. will total about $38 billion.

The sharp increase in the industry's capital investment has been based on the vigorous postwar expansion of facilities in all divisions. But the gain has been accentuated by the inflated costs of all new facilities. Although the industry now has almost three times as much investment as at the end of the war, it has perhaps only about twice as much in physical facilities. For postwar costs have been double those prevailing before the war.

Spending in 1955. Capital expenditures of the petroleum industry in 1955 are running around those of 1954 and in some categories higher. This trend is in conformity with the current record high capital expenditures being made by U. S. industry in general. It is indicated, therefore, that the petroleum industry will spend for facilities in 1955 over $5 billion. It is drilling about the same number of wells as in 1954, but the average cost per well probably is higher, indicating some increase in capital spending in the production division. For refineries and chemical plants the industry is spending about the same in 1955 as in 1954. New investments in marketing facilities are indicated to be somewhat higher this year. For trans-

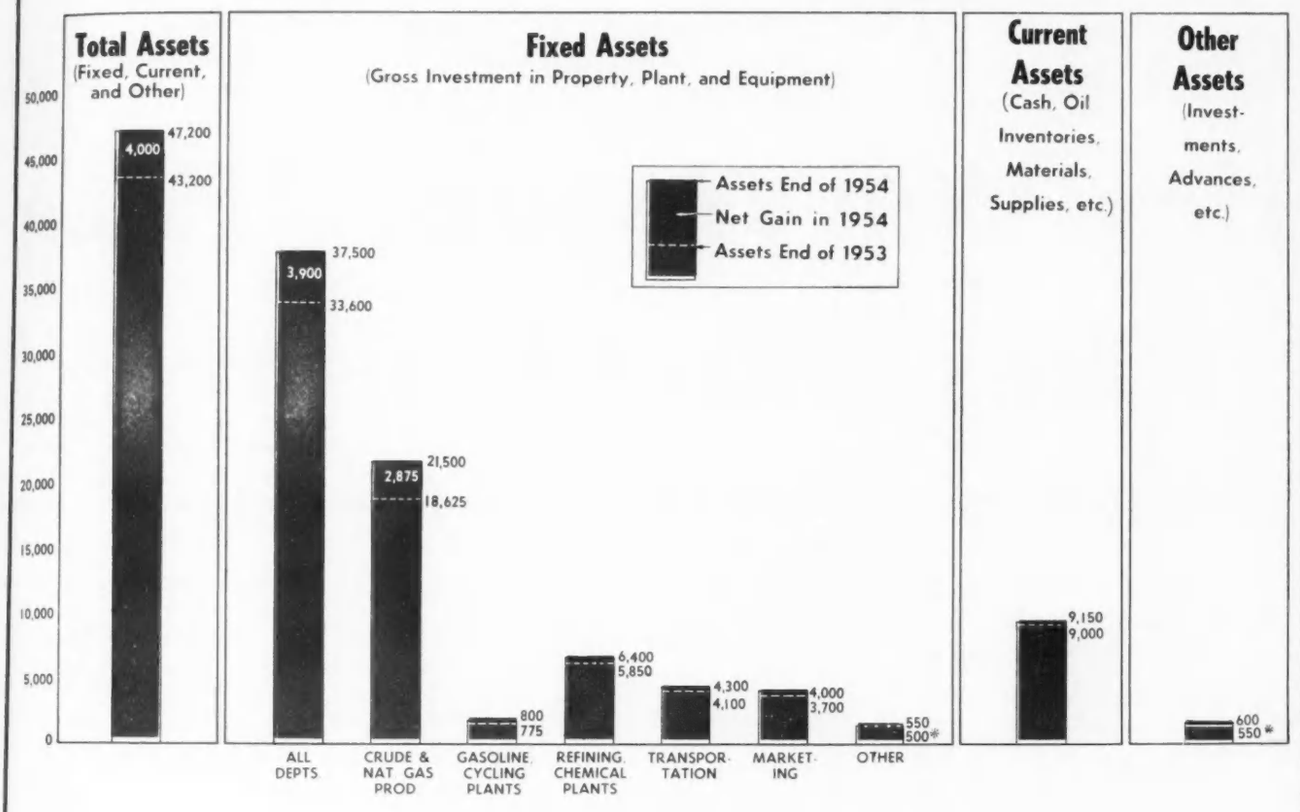
Text continued on Page 48

Estimated Assets Employed (or Investment) in U. S. Petroleum Industry, December 31, 1954

ITEM	Net Assets		Gross Assets	
	$ Million	% of Total	$ Million	% of Total
Current Assets	9,150	31.5	9,150	19.4
Property, Plant and Equipment	19,350	66.6	37,500	79.4
Other Assets	550	1.9	550	1.2
Total	29,050	100.0	47,200	100.0

Source: Chase Manhattan Bank Bulletin, "Financial Analysis of the Petroleum Industry for 1954."

Assets Employed (or Investment) in U. S. Oil Industry at End of 1953 and 1954 . . . in Millions of Dollars



*Represents 50 Decreases

Recent Annual Expenditures for and Current Investment in Property, Plant, and Equipment of U. S. Petroleum Industry

Source: Chase Manhattan Bank Bulletin, "Financial Analysis of the Petroleum Industry for 1954."

	Estimated Expenditures for Property, Plant, and Equipment in Recent Years						Estimated Investment Dec. 31, 1954 in Property, Plant and Equipment			
	1953		1954		9 Years 1946-1954		Gross		Net	
Department	$ Million	% of Total	$ Million	% of Total	$ Million	% of Total	$ Million	% of Total	$ Million	% of Total
*Crude and Natural Gas Production	2,975	64.7	3,700	69.1	21,730	66.8	21,500	57.3	10,200	52.7
Gasoline and Cycling Plants	125	2.7	100	1.9	745	2.3	800	2.1	450	2.3
Transportation Department	450	9.8	350	6.5	2,800	8.6	4,300	11.5	2,650	13.7
Pipe Lines	325	7.1	275	5.1	2,045	6.3	2,950	7.9	2,000	10.3
Marine	100	2.2	50	0.9	610	1.9	1,025	2.7	525	2.7
Tank Cars; Motor Transport	25	0.5	25	0.5	145	0.4	325	0.9	125	0.7
Refineries and Chemical Plants	675	14.7	800	15.0	4,215	13.0	6,400	17.1	3,300	17.1
Marketing	325	7.0	350	6.6	2,495	7.7	4,000	10.7	2,450	12.7
Others	50	1.1	50	0.9	515	1.6	500	1.3	300	1.5
Total, All Departments	4,600	100.0	5,350	100.0	32,500	100.0	37,500	100.0	19,350	100.0

* Expenditures include cost of drilling dry holes, but exclude exploration expenses and lease rentals charged to income account. Investment includes only natural gas producing, transmission, and distribtuion facilities of oil companies.

a WORLD OIL report

This report represents a combined effort by the WORLD OIL staff on a timely question

How Will Wage and Price Hikes Affect Industry?

Recent increases in wages and costs of materials will appreciably affect the oil and gas industries, drilling contractors, and equipment manufacturers.

Oil and related industries must be prepared to pay more for labor and materials. Costs to be materially higher.

Competition is keen and it is questionable whether prices can be raised to offset increased costs.

Large volumes of business will help to cover extra costs. But operating economies and efficiency will also be needed.

THE OIL AND GAS industries, drilling contractors, and equipment manufacturers may be affected adversely by the inflationary developments of the past several weeks. Costs of labor and materials henceforth will be substantially higher, and it remains to be seen whether the increases in costs can be offset by such factors as larger volumes of business, more efficient operations, or higher selling prices.

The possibilities for higher prices of petroleum products are limited by ample stocks and large reserve capacity for producing and refining oil. Consequently, if higher costs are compensated, they apparently will have to be offset largely by the prospective large volume of business and increased efficiency of operations. There will be increased pressure for achieving operating economies.

The July 1 steel strike resulted in a 15 cents an hour wage increase for steel workers, and was immediately followed by an increase of $7.50 a ton or about 5.8 percent in basic steel prices, with some forms of steel expected to go up 10 or 12 percent. This steel price raise was the largest since 1948. The steel companies said it was based not only on the wage increases but also on higher costs of goods and services, state and local taxes, and need of funds for building more steel plants.

The petroleum industry will be affected more than many other industries by the steel price increases, as it is a large user of steel goods and uses steels that were marked up the most. The industry uses large tonnage of tubular goods, and the price increases on tubular goods were greater than on most other items. One major steel company announced price rises of from $10.50 per ton for plain end seamless to $16.75 per ton for drill pipe, and another announced increases in tubular goods prices ranging from $11.30 per ton to $18.45 per ton.

Higher wages are due to spread throughout industry, and many lines will raise prices of manufactured goods, based on higher wages and higher steel costs.

Even before the steel price increase, prices were up 7 to 20 percent over a year ago for other important metals, including aluminum, lead, zinc, and copper. And at mid-July, the producers of some of those metals still faced renewal of contracts with their labor.

The petroleum industry during recent months generally raised wages an average of about 10 cents per hour, plus liberalizing employe benefits, and also some new contracts

contained provisions for reopening negotiations on wages later this year.

Oil companies also have had increases in costs in constructing new facilities, in upgrading gasoline, in expanding the extremely expensive offshore exploration and development, with its costly bonuses and high royalties, in holding back potential production in Texas and elsewhere, and in other ways. Curtailed allowables in Texas and some other states have held down volumes of crude production and revenue for producers. Adding to all the other increases in costs now are higher costs of materials as well as labor.

Costs to Be Higher

Members of WORLD OIL's staff in all sections of the U. S. contacted oil men, drilling contractors, and equipment manufacturers, and found general agreement that recent increases in wages and in prices of materials will materially affect their costs and operations. These men of the oil and related industries feel that they ought to pass along their added costs. But just how, and if, they can be passed along is another matter.

No one felt confident that prices could be raised to cover the extra costs. Most adopted the "wait and see" attitude. Still more materials price increases may be in the offing, as wage hikes and unemployment compensation plans are being demanded by other labor groups, including those that produce copper, aluminum, brass, and other metal products used by the oil and related industries. In view of the still unfolding developments, it may be impossible to estimate future costs very accurately until later in the summer or fall.

While it may be well to "wait and see," higher costs already are a reality, and they are cutting into profit margins.

Oil Markets Steady

Heretofore, the markets for petroleum products have not been strong. However, inventories of crude and products now are getting in fairly good position. The improvement has been achieved by holding crude production and refinery runs within conservative limits and with benefit of good demand for petroleum products.

In the existing circumstances, it is questionable if competitive conditions would allow the industry to offset higher costs by increases in prices of petroleum products or crude oil. Before the middle of the year there was a cut of 15 cents a barrel in the postings of one major company for the crudes it was purchasing in Kansas. It explained that the price reduction was necessary to make the particular crudes involved worth their cost to the company. The reduction was not met by other purchasers.

More recently, as of July 11, prices of Pennsylvania grade crude were increased 10 cents a barrel, on the initiative of South Penn Oil Company. Bradford district crude was raised to $3.60 a barrel, Middle District crude to $3.47, Southwest district oil to $3.18, and Eureka to $3.07. Those crudes previously were increased 15 cents a barrel in January of this year. These increases have been officially explained as reflecting a steady increase in demand for crude oil by refiners. The crude is available in limited volume and is desirable for its high yield of premium quality lubricating oils.

The markets for petroleum products have been mixed and there have been both increases and reductions in prices within the past month. At mid-July gasoline prices were increased in five western states by Standard Oil Company of California, which raised regular grade 0.3 cent and premium grade 0.5 cent.

About the same time, Socony Mobil Oil Company posted reductions of 0.3 to 0.5 cent per gallon in its wholesale prices throughout 11 Eastern states, including New England, New York, New Jersey, Pennsylvania, Delaware, Maryland, and Washington, D. C. Price wars have depressed gasoline prices in that region, and the reductions were made to meet the intense competition. The reductions were the first since July of last year, when Socony cut its tank wagon prices to dealers by ½ to 1 cent a gallon. A month later it raised prices back generally 0.8 cent a gallon, reversing a decline that had persisted since November, 1953. In making the recent cut, Socony stated. "The reductions come at a time when recent wage and quality increases would normally tend to dictate higher wholesale prices."

Prices of bunker oil and heavy fuel oils at the middle of July were increased on both the Atlantic and the Gulf Coasts. Esso Standard Oil Company, marketing subsidiary of Standard Oil Company (New Jersey), increased Bunker C 18 cents a barrel at Philadelphia and 15 cents at other Atlantic ports, pricing it as $2.50 a barrel, delivered by barge, at New York harbor. At the same time the company increased East Coast prices of No. 4 fuel oil 8 cents a barrel and No. 5 fuel oil 9 to 11 cents. Similar reductions were extended by the company later to the Gulf Coast.

The higher prices for residual fuel oil have resulted from several causes. Yields of residual at U. S. refineries have been decreasing as the yields of lighter products have been stepped up in new plant facilities. Meanwhile, there is now a holding down of U. S. residual imports, in line with current governmental and industry policies of trying to keep imports within the 1954 ratio to domestic production. U. S. stocks of residual have fallen below year-ago levels. Also partially responsible for higher fuel oil prices in the U. S. is the fact that supplies are tight throughout the world market and that tanker rates are unseasonally rising. Bunker oil now is in strong demand in both of two major world sources, the Caribbean area and the Middle East, with the large needs of the growing British fleets an important factor.

Markets for distillate fuel oils and kerosine have held steady, as the summer buildup of stocks for winter use proceeds in orderly fashion. The inventories are only moderately exceeding the year-ago trend, in anticipation of increased demand.

Continued on next page

Industry in Good Position

Underlying oil industry markets now is a comparatively sound supply and demand relationship. Total demand for all oils in the past few months apparently has been around 5 percent above last year. With demand relatively high and crude production and refinery runs only proportionally above a year ago, stocks of crude, gasoline, and residual have been held below last year's levels, and stocks of distillate and kerosine have not greatly exceeded those of last year. Continued moderation in crude production is promised. Texas, the leading producing state, has extended July's relatively low allowables through August. Imports of crude lately have been about the same as a year ago, and product imports have not been violating the new policy on import curtailment. Encouraging to the industry is the fact that gasoline, its principal revenue producing product, has been in especially good demand. Sales have been around 6 percent or more above a year ago, as production and registrations of automobiles have been at all time record levels.

Ernest O. Thompson of the Texas Railroad Commission has pointed out that regulatory authorities need to be careful in setting oil quotas for the latter half of 1955. The outlook for Texas oil producers is not gloomy, he said, but neither are there grounds for great optimism. "We are in a period of great surplus," he said, "and we need to be careful during the last six months of the year." He considered decreasing gasoline stocks optimistic, but said active drilling was adding to a supply of crude that already exceeded market demand.

Danger Signs for Business

The petroleum industry outlook is affected not only by conditions within the industry but also by the general business outlook, which now is viewed with some misgivings by some analysts. The First National City Bank in its monthly business review cautioned, for example, that the business recovery has reached a stage at which it might take an unsound and ultimately harmful turn. "Private and public economic policies should be reviewed," the report said, "with the object of checking boom tendencies and maintaining the stable prosperity which has been enjoyed up to this time." Recent automobile industry wage increases have set in motion, said the bank, "an influence for higher prices of manufactured goods, and hence a stimulus to more liberal forward buying and inventory accumulation." Heavy and speculative inventory accumulation would generate a "bubble on top of the boom," the bank warned, "and if it should develop during the next six months, the outlook for 1956 would be weakened accordingly."

Officials of the Federal Reserve have recognized that upward pressure on prices is building up. They are watching the possibility that business men and consumers may hasten purchases to beat possible price hikes or shortages. Such action, they feel, might lead later to a business recession comparable with those of 1949 and 1954.

Metal Goods Costlier

The petroleum industry is an exceptionally large user of steel and other metals, virtually all of which have now gone up sharply in price. In 1954 the oil and gas industries used 7.8 percent of all steel produced, having consumed more than 5½ million tons. The recent increase of about $7.50 a ton in the basic price therefore meant more than $40 million annually for the oil and gas industries, and on some of the products used by the industry the actual increases will be double the basic price increases. On alloy steels, particularly, price increases may be sharp. The price of copper is 20 percent above a year ago, with worldwide supplies tight. Zinc is nearly 15 percent higher in price and may go higher. Lead and aluminum are both up about 7 percent and threaten to rise further.

Some producers of goods made from the costlier metals will urgently need to mark up their prices on the manufactured products, and it appears inevitable that the oil and gas industries eventually will have to pay higher prices for many items of equipment. An official of a large equipment manufacturing company which makes oil industry drilling equipment, tanks, welding equipment, and furnaces, as well as automobile parts and items in other lines was quoted as saying that his company would have to pass the recent steel price increases on to the consumers in most cases.

Mid-Continent Costs Up

The impact of increased steel prices and oil field wages already is being felt in the Mid-Continent area. Operators figure the steel increase will cost them about $12 a ton for tubular goods or about 8 percent additional, instead of the $7.50 per ton as announced by the steel industry. Oil field steel is more expensive. Casing went up about $11.60 a ton, tubing about $15 a ton, and drill pipe about $16 a ton.

Indicative of what the recent increases in steel prices mean in cost of drilling wells, the following are actual examples of advances in costs:

- A 6800 foot well in the Oklahoma Panhandle requires 112 tons of casing and tubing, and these tubular goods for this well now cost $1350 more than before the steel price increase went into effect July 6.
- A 6800 foot well in the Golden Trend area of Garvin County, Oklahoma, requires about 85 tons of steel, and the increase in cost amounts to $802.60 per well.
- A 4000 foot well in Southern Oklahoma needs 60 tons of steel, and the greater cost of this amounts to $738.
- An 11,600-foot well in Louisiana would require 255 tons of steel. The increase in price will make the tubular goods for this well cost $3555 more than before July 6.
- The average well in the Tri-State area of Illinois, Indiana, and Kentucky requires 42 tons of steel for a 3000 foot well. These wells will cost $520 more, so far as steel is concerned.

The impact of increases in costs of steel and in oil field wages will fall largely on producers, it is indicated, as

drilling contractors will attempt to reflect the inflation in their well drilling bids. Drilling contractors continue to agitate for better prices, declaring there has been no appreciable increase during the past two years.

Oil compaines contacted in the Mid-Continent indicated that there would be no curtailment in drilling operations on account of higher costs, although this may result next year when the new budgets are proposed. Executives stated that they would keep on looking for oil, and that the increases of from $500 to $3500 per well would not prevent them from drilling what they considered to be good prospects. But funds available for drilling will have to be made to find and develop as much oil as possible, they said, and they are going to take a harder look henceforth at all prospects.

Supply companies do not anticipate any curtailment in buying during the balance of the year.

Independents Squeezed

Independent operators with marginal production will be particularly squeezed by the increased prices of materials henceforth. The price hike involves a $400 increase for tubular goods alone in a 4000-foot well, and when christmas trees, lead lines, tanks, etc., are included, increases in costs will amount to $1000 for a 4000-foot well. However, the manufacturer is expected to absorb some of the increase in the case of such items as tanks.

Fewer marginal wells now will have pipe set in them, for now it will take more oil to pay out the cost of the casing and tubing. More dual and triple completions may be made. Unitization of multiple pay fields may be more urgent now. There may be a reduction of cutthroat offset drilling in non-unitized multiple pay fields. More risks may be taken in casing practices to save pipe. The used pipe market may be enhanced. More marginal and stripper wells may be pulled for salvage. The practice of shopping and coupling line pipe and of rethreading old drill pipe for casing for shallow, low pressure wells may be renewed. Also, domestic producers may crowd the safety factors a little closer in ordering new pipe, buying lighter pipe to save tonnage and money although staying within the safety limits as to collapse and tension.

California Sees Price Hike

Oil industry executives in California who were contacted by World Oil were unanimous in their belief that recent salary and materials price hikes would materially affect their operations and financial health and that there would be a need to raise petroleum industry prices to compensate for the increased costs. Unless price relief is obtained, they said, it will be increasingly difficult to finance operations without going out and borrowing more money.

In the past, such increases in costs usually have resulted in product price hikes, but of course it may be too early yet to tell just how much any such price increases might amount to. West Coast companies in recent weeks, one by one, have raised gasoline prices by amounts ranging up to 0.8 or 0.9 cent per gallon. Some of this increase has been attributed, however, to the higher cost of manufacturing the premium quality high octane gasolines that recently have been developed through expensive modernization and building of new refining facilities.

On the West Coast, as in the Mid-Continent, it was quickly found that the oil industry would experience generally higher steel price boosts than were at first apparent. Whereas certain highly competitive types of steel, such as hot rolled sheet, were raised $7.50 or $8 per ton, some of the steel the oil industry buys, such as drill pipe, will average $11 to $15 per ton in increased costs. One contractor said he understood 4½-inch drill pipe would be increased by $16.75 per ton, which at about 120 feet per ton would amount to a price increase of about 13 cents per foot. On a 10,000 foot string, this would amount to an additional $1300 approximately in cost.

Contractors' Cost Up

A California drilling contractor quoted a major supply company representative as saying that oil field drilling equipment (machinery) probably would be increased by from 8 to 10 percent.

Opinion was divided as to whether California drilling contractors would be able to pass along their increased costs of both labor and materials. One view was that with perhaps only 75 percent of the rigs in California working, drilling prices could not be raised, since the idle rigs constituted a depressant on prices. Contractors holding this view thought the only answer to the newly increased costs would be in doing a better, more efficient job, absorbing the costs themselves.

In contrast with the above belief was the opinion that the drilling contractors have just about reached the end of their ability to absorb extra costs; that almost certainly, part of the current price hikes and salary hikes will have to be charged to higher footage rates.

There was agreement, of course, that contractors ought to be able to pass along such increased costs. But whether the law of supply and demand of drilling rigs will permit such passing along remains to be seen. As evidence of the problem existing in whether prices can be hiked (footage prices), one of the largest contractors on the West Coast said their business this year was about 17 percent below that of 1954, in dollar volume, yet they have experienced the same volume of work.

Equipment Costs to Rise

Oil industry equipment manufacturers, like oil companies and drilling contractors, are being put in a squeeze between current selling prices of their products and their lately increased costs. Here again it is the alloy type steels and specialty goods that are taking the highest jump in costs. Whereas the basic steel price hike may be in the order of 5½ to 7½ percent, the equipment manufacturers' additional costs may range from 11 to 12 percent.

A leading equipment manufacturer on the West Coast intends to hold off until around the last quarter of the

year before making any move to raise prices. They would like to raise their prices now to reflect their increased material costs, but they decided it would be best to wait a while, feel out the market, study all their costs, etc. before making a move price-wise.

It appears that equipment price hikes are not a question of *whether* but one of *when*. By later on this year, also, a better idea will have been gained by equipment manufacturers as to what their own new salary and wage scales will be; also, since copper and certain other metal industries currently are going through the strike-wage hikes-price hike spiral, the new prices of these materials likewise will have to be considered in the over-all picture.

The equipment manufacturer, particularly the company that specializes in a large measure in down-hole equipment, already is hard pressed between two industry demands. On the one hand he is asked to design equipment that will stand the higher pressures, temperatures, and operating conditions of deeper and deeper wells. On the other hand, he is being asked to adapt his equipment more and more to smaller diameter permanent-type completions. He therefore must make his equipment thinner, slimmer, yet with higher strength—all of which means more high priced alloys; alloys which currently are taking the worst beating price wise in the present steel price increases. So, it would appear that the equipment manufacturer has only a limited profit margin, which is not enough to absorb the new price increases; he must pass them on to the customer.

The price hikes on steel of the various types used by manufacturers range from as little as 7 percent to as much as 22 percent, it is estimated.

International Operations

The effect of higher U. S. wages and steel prices upon the big international oil companies is not expected to be great. They are not operating on narrow margins of profit and will continue to buy steel as needed. However, they buy foreign as well as U. S. pipe and other steel goods on competitive basis, and there may be some tendency toward using more foreign pipe and less U. S. pipe overseas, although no general changeover is expected. Costs of materials, such as copper, have gone up also for foreign manufacturers of metal goods.

Almost no foreign pipe is coming into the U. S. now, nor is there expected to be any big increase in the pipe imports as a result of the U. S. price hikes. —**The End**

INDUSTRY INVESTMENT

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portation facilities the industry is spending less this year, but this decrease probably is more than offset by increases in other divisions of the industry.

Spent in 1954. The industry in 1954 made record capital expenditures of $5.35 billion in the U. S., an increase of $¾ billion or 16.3 percent over the $4.6 billion spent in 1953. These estimates were made by Frederick G. Coqueron, petroleum analyst, the Chas Manhattan Bank, New York, in the recently published pamphlet, "Financial Analysis of the Petroleum Industry for 1954." (See table.)

Of the $5.35 billion spent in 1954, $3.7 billion or 69.1 percent was for leases, wells, and equipment for producing oil and natural gas. This was an increase of almost $¾ billion or nearly 25 percent over the $2.975 billion (64.7 percent of total) spent in the production division in 1953.

New gasoline and cycling plants cost $100 million or 1.9 percent of total capital expenditures in 1954. That was a decrease from the $125 million (2.7 percent) similarly spent in 1953.

In the transportation division the industry in 1954 made capital expenditures totaling $350 million or 6.5 percent of the total, a decrease from the $450 million or 9.8 percent of total spent in 1953. The $350 million for 1954 included $275 million (5.1 percent of total) for pipe lines, compared with $325 million (7.1 percent) for 1953; $50 million (0.9 percent) for marine facilities, against $100 million (2.2 percent) the previous year; and $25 million (0.5 percent) for tank cars and motor transport, the same amount as in 1953.

For refineries and chemical plants in the U. S. the industry in 1954 spent $800 million, or 15.0 percent of total outlays, an increase over the $675 million or 14.7 percent spent in 1953.

Capital expenditures in marketing in 1954 amounted to $350 million or 6.6 percent of the total. That was an increase over the $325 million or 7.0 percent estimated for 1953.

Other capital expenditures in 1954 were placed at $50 million or 0.9 percent of the total, the same amount as in 1953.

Investment at Peak. Gross investment in the U. S. petroleum industry at the end of 1954 was $47.2 billion, according to the Chase Manhattan Bank report. That was $4.0 billion more than the $43.2 billion of gross assets at the end of 1953. Of the new total of $47.2 billion, fixed assets, in the form of property, plant, and equipment, accounted for $37.5 billion or 79.4 percent of the total. Current assets, including cash, oil inventories, materials, supplies, and so forth, represented $9.15 billion or 19.4 percent; and other assets constituted $550 million or 1.2 percent.

Of the $37.5 billion gross investment in property, plant, and equipment at the end of 1954, $21.5 billion or 57.3 percent was in facilities for production of crude oil and natural gas; $800 million or 2.1 percent in gasoline and cycling plants; $6.4 billion or 17.1 percent in refineries and chemical plants; $4.0 billion or 10.7 percent in marketing facilities; $500 million or 1.3 percent in miscellaneous facilities; and $4.3 billion or 11.5 percent of the total in transportation properties. The transportation investment included $2.95 billion or 7.9 percent of the industry total in pipe lines; $1.025 billion or 2.7 percent in marine facilities; and $325 million or 0.9 percent in tank cars and motor transport.

ACKNOWLEDGMENT

The chart herewith is based on data from the Chase Manhattan Bank bulletin, "Financial Analysis of the Petroleum Industry for 1954," by Frederick G. Coqueron, petroleum analyst.

Health Program Aids Employe and Employer

- **Periodic physical examinations sponsored by a company can reduce incidence of disease and forestall accidents.**

- **Costs to a company are more than offset—employes lose less time at work, fewer accidents cut workmen's compensation costs and morale is improved.**

By DR. E. P. LUONGO, Medical Director,
General Petroleum Corporation, Los Angeles

BENEFITS TO EMPLOYES and employer have well justified the costs of General Petroleum Corporation's program of physical examination for employes. The health and safety of employes have been promoted significantly. Employes lose less time at work and are more efficient. They have fewer accidents and thereby cut workmen's compensation costs. The company gains a channel of communications with employes, and morale is improved.

The method of periodic physical examinations for 6000 employes in General Petroleum Corporation consists of a planned procedure, furnished at regular intervals, depending on age and occupation. The spirit governing the examination is one of spontaneous cooperation, based on attractive benefits pointed out to employes through appropriate educational media.

Examinations are offered to all employes. Those under 40 are scheduled every two years, and those over 40 every year. Some employes with certain physical defects may be examined every three or every six months. Some in occupations with certain potential occupational hazards are also examined at more frequent intervals.

Physical examinations are performed either by physicians of the medical department or by private physicians designated by the medical department. The scope of the examination is determined by medical history regarding signs or symptoms showing departure from normal organic, emotional, or mental health, guided to some extent by a brief questionnaire filled out by the examinee.

Questioning may relate to human or job relations, with particular reference to conflict at an occupational level. Some psychologic evaluation pertaining to job interest, aptitude, or job placement, is done when indicated. Insight into family relations is obtained, when necessary, by tactful questioning regarding family problems, marital conflicts, and financial worries.

With older employes, particularly those reaching retirement age, an attempt is made to evaluate adjustment to age, including diet, physical exercise, use of tobacco and alcohol, as well as questions about hobbies or avocations, all of which is considered part of the medical history.

This program applies to all employes, and there is no attempt made to evaluate periodic examinations with any line of demarcation drawn between executive and non-executive. Unfortunately, there is a growing tendency today to overemphasize the health problem of executives. In our experience we have found that executives are no more prone to ulcers, coronary disease, or various neuroses involving "dependent behavior" than are the non-executives in the same age group.

Organic health appraisal. Let us now evaluate the appraisal of the employe's organic health—in terms of the benefits it produces. First, the benefits to employes:

By regular examination, healthy employes are reassured against doubts as to their physical condition; hypochondriasis is reduced. Through advice given to employes regarding physical defects which may be found, employes are assisted in maintaining their health. The impact of disabling organic disease is reduced by early detection, and employes are encouraged to seek treatment from their private physicians before irreparable harm is done. In General Petroleum, the following has been experienced (with due consideration given to age of employe population):

- The incidence of disabling and fatal cardiovascular heart disease has been decreased 15 percent since 1948.
- There have been no disabling consequences among diabetics since 1950.
- The incidence of overweight has been reduced from 25 percent of employe population in 1951 to 15 percent of employe population in 1954.
- Mortality from malignancies of internal organs in males has dropped 33 percent since 1948.
- Disabling diseases of the digestive tract have dropped 20 percent from 1948 to 1954.
- In females, the mortality from breast and pelvic malignancies has decreased 50 percent since 1948.

As a result of reduction in morbidity of disabling illnesses, there has been a concurrent reduction in wages lost due to absenteeism for chronic degenerative diseases and malignancies.

To General Petroleum as an employer, the appraisal of the organic health of employes yields these benefits:

Between 1948 and 1954, the company has experienced less industrial accidents due to pre-existing physical disabilities in all age groups. As a

Here are the conditions for good health— How do YOU measure up?

Health does not consist only of being free from mental or organic disease, declares the author. He says conditions for health in any individual are:

- Past history
  1. A wise "selection" of antecedents in preceding generations.
  2. A reasonably happy and emotionally-secure childhood.
- Present or adult history
  1. A satisfactory home and occupational situation.
  2. Freedom from organic or mental diseases.
  3. A sense of humor.
  4. Opportunity for self-expression in creative endeavor.
  5. Sufficient rest and non-competitive but productive leisure, with ability to change pace.
  6. Physical, mental, cultural, and educational fitness for occupation.
  7. A true sense of humility toward one's ability, both in success and in failure.
  8. Adequate social mores or roots in the community, and a willingness to bring benefits to the community without thought of material gain. This requires a charitable attitude toward one's family, friends, and neighbors.
  9. Ability to adapt to age (more psychologic than physiologic).
  10. A spiritual point of reference outside of secular or material existence, and sufficient faith to leave some things beyond mortal control to the "powers that be."

result, Workman's Compensation costs for certain types of injuries and diseases have been reduced. For example: costs for industrial hernias have dropped 40 percent since 1948. Costs for serious back injuries were reduced 33 percent. We have had no claims for "industrial" heart cases in six years. Occupational disease of skin has been reduced 80 percent.

In the field of industrial hygiene, the physical examinations have enabled the company to control more effectively the effects of possible unhealthful exposures in the working environment. We have been in a better position to meet the requirements of laws and regulatory orders involving the health of personnel on the basis of information obtained on physical examination which has been transmitted to the management.

Finally, the community at large benefits:

The economic "health" of a community is affected by the health status of workers living in that community. When a communicable disease, such as tuberculosis, is detected in its early stage at the time of periodic examination, the spread of this disease is inhibited. When there are a maximum number of workers reporting to the job, and working at an optimum level of efficiency, the butcher, the baker, and the banker are benefited. In preventing disabling consequences of diseases, there is a reduction in the number of families suffering large economic losses from serious illness or early death of the bread winner. Some of these families could become public charges.

These are the benefits to the employe, the employer, and the community at large which spring from the first of the three appraisals used in our program of periodic physical examinations.

Mental health. Now consider mental health and psychosomatic complaints:

Any physician with some interest in psychologic or emotional reaction can detect most of the cases in industry where there is an interplay of stress, either on an occupational or on a non-occupational basis.

There is some doubt here as to the advisability of formal programs in industry for psychologic or psychiatric evaluation of employes. By formalizing psychologic or psychiatric services in industry, there is a tendency to overestimate or overextend the area of employe population needing this service. Only a very small percentage are candidates for formal psychologic evaluation, and there are an even smaller group for psychiatric evaluation. From 85 to 95 percent of employes with emotional difficulties, either occupational or non-occupational, can find solutions to their problems with the help of their foremen or supervisors, the industrial physician, the private physician, family, friends, relatives, or a minister. Any employe who can solve this emotional conflict with the aid of one of these sources, has no business in the office of a phychiatrist or a psychologist.

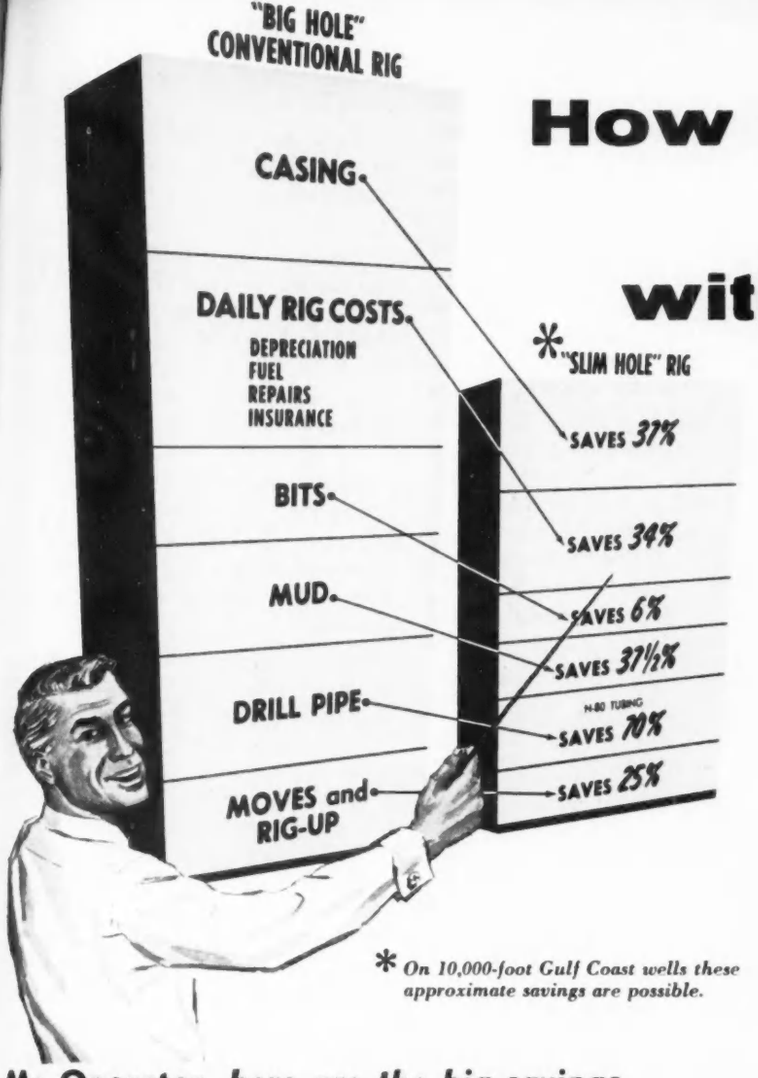
Psychosomatic or mental health problems are considered at the time of periodic examination of the employe, or on special referals to the medical department by foremen and supervisors who may suspect that the employe is having emotional difficulties on the job. In recognizing such an employe as a complete individual with a home, family, financial worries, as well as problems related to other employes and supervisors, the majority of these cases can be handled by analyzing the stresses with the individual. We attempt to help the employe gain an understanding and insight into his behavior. However, the appraisal of the employe's mental health, his psychosomatic complaints, and the potential sources of stress which may exist in his environment, constitute a large and significant part of our periodic examination program.

Let us evaluate this appraisal, from the separate viewpoints of the employe, the employer, the medical profession, and the community at large, in terms of benefits produced.

First, benefits to the employe:

Benefits derived from periodic examination in the field of emotional and mental health are as important as those related to organic health. By

How to cut costs with SLIM HOLE drilling . . .



* *On 10,000-foot Gulf Coast wells these approximate savings are possible.*

One practical approach to reducing exploration and development costs is to drill a smaller than conventional hole using less expensive equipment to effect a reduction in daily operating costs.

Mr. Operator—*here are the big savings*

- **SMALLER CASING...**
  The trend toward smaller diameter pipe will effect substantial savings over conventional casing sizes.
- **LOWER OPERATING COSTS...**
  A Slim Hole rig has lower capital investment, depreciation, insurance, taxes, maintenance, and will require much less fuel than a conventional "big" rig. This reduction of daily operating costs is reflected in logging, completion, round trip, and drilling time charges.
- **CHEAPER BITS...**
  Bearings and tooth structure of today's Slim Hole bit is more efficient than those of a year ago. In some areas the Slim Hole bit performance does not compare with the conventional sizes, but because of their lower cost, savings are still effected.
- **LESS DRILLING MUD...**
  The smaller hole will result in smaller mud bills and smaller mud pits.
- **SMALLER DRILL PIPE...**
  It is often practical to use cheaper, small diameter pipe having a low depreciation. If pressures are inadequate, larger diameter, but cheaper tubing grades can be used and will result in less pressure losses.
- **LOW-COST MOVES...**
  Slim Hole rigs require less rig-up time, fewer loads, and cheaper site preparation.

Present Well Costs Too High!

Deeper drilling depths continue with resultant disproportionate rise in drilling costs. This kills the economic incentive to drill new wells.

Oil companies are searching for ways to reduce drilling costs so they may continue to drill the growing number of wells necessary to maintain U. S. producing capacity. Slim Hole is one answer.

Only one well in nine drilled in search of new oil finds production. Even in development drilling where nearly 50,000 wells are drilled annually, almost 40% are dry holes. In many areas, Slim Hole drilling will mean more wells for the same money.

Don't Go Into Slim Hole Drilling "Blind"

Let us show you how Cardwell equipment can cut your drilling costs... Your copy of "Slim Hole Drilling Facts" will soon be off the press. Write Philip L. McLaughlin, former Drilling Editor of *World Oil*, and now Head of Drilling Research, Cardwell Manufacturing Company, Inc., Wichita, Kansas, for your free copy.

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considering an employe as a total or "whole being," we have been able to assist and counsel him on problems for which he often hesitates to seek counsel from other qualified sources. As a result, the incidence of "nervous breakdowns" or severe disabling psychoneurosis among employes in this company has diminished 25 percent during the six-year period between 1948 and 1954. By showing an interest in their emotional problems, employes receive a real feeling of "belonging" in their work with the company.

Next, the benefits to the employer: There has been a reduction in explosive human relations problems due to emotional upsets. Industrial accidents due to emotional problems also have been fewer. The company has another channel of communications with employes, and the trained observation powers of medical personnel are available to management in spotting personnel and human relations problems. By showing a concern for employes as individuals, the company benefits in improved morale.

To the community at large, the appraisal means there is a reduction in the number of disabling neuropsychiatric cases in the community and this decreases the number of families suffering economic losses.

Health habits. The third element in our periodic examination is the employes' health habits.

At time of periodic physical examination we question the employe with regard to his nutrition, physical exercise, avocations, and sometimes on how he "treats" his private physician. We have found that a large number of employes have functional ailments caused by too much work or too much play.

Avocations are extremely important to those employes in industry who may have unrealistically high standards with regard to their mission in life or who have a wide discrepancy between their capabilities and goals. Some of these cases can be adjusted through suggestions as to recreation and avocations, and we feel that this type of advice may be pertinent to the prevention of coronary attacks in some cases.

At the time of periodic examination we attempt to educate employes on the significance of questions which physicians may ask concerning their health. We point out the limitations in medical science, both in the diagnostic and therapeutic field. We attempt to condition them to the idea that the shock of knowing about a disease, resulting from a doctor's diagnosis, wears off quicker than the uncertainty of continual worry and wonderment about the possibility of disease.

Most, in fact 95 percent, of the employes would rather face facts than live in false security, a state of mind which is spawned to greater degree by not knowing than knowing the facts. Even in the case of any employe with a mortal disease, the majority like to be told so that they can mend their fences, moral, financial and otherwise.

The "bogey man" in hiding is much more of a threat than when out in the open. We can never lick malignancies with our present knowledge until we get the "bogey man" out of the basement of peoples' subconscious by encouraging them to undergo periodic checkups. Hush-hush attitudes on malignancies and other diseases are not only reactionary but foolish.

What are the benefits which arise from the appraisal of health habits of employes?

The appraisal of health habits at time of periodic examination gives the employe an additional opportunity to further his personal education and information on health and hygiene. Because of this knowledge he enjoys a better relationship with his private physician, since he feels he can intelligently discuss his health problems with the physician. The health education he receives as part of his periodic examination may also spare him confusion, time, and expense by being able to evaluate more intelligently unorthodox, costly, and sometimes dangerous, health promotion methods and schemes advertised in a community.

The information these employes receive on health education is disseminated widely through a community by word of mouth. This makes an ever-increasing contribution to the betterment of community health standards.

The liabilities. What are the liabilities? In a true evaluation, as we are attempting here, we must not only look at the assets produced by what we are evaluating, we must also look at the liabilities.

What are the liabilities produced by a program of periodic physical examinations for employes?

From the employe's viewpoint, if information on periodic physical examinations is used improperly and causes him temporary or permanent economic losses in reassignments, lack of promotion, or termination, then from his viewpoint a scheduled periodic examination can be poor quality action and a loss.

Some employes also sustain losses in having a false sense of security following a periodic examination and later experience a heart attack or some other serious disease (2 to 3 percent).

If a periodic examination program is carried out in a manner which causes frequent labor relations difficulties, then the procedure would have to be considered as a possible poor quality action and the difficulties would be considered losses. We find that occasionally a decision resulting from a periodic physical examination becomes a labor relations matter, but these situations usually can be resolved amicably by a frank discussion between the industrial physician and union representatives.

So there we have the assets and the liabilities which grow out of a program of periodic physical examinations. We are ready to "strike a balance."

In providing periodic examinations for employes, American industry is contributing its share toward the improvement of health standards in communities.

These programs should be more widespread in industry so that advanced stages of preventable or curable diseases will be rare occurrences in our clinics and hospitals.

The value of periodic examinations has been challenged. Some suggest that the benefits derived from periodic examinations may not be worth the cost in time and money and the risk of creating hypochondriasis in employes.

Value proven. We have drawn up "balance sheets," each recording assets and liabilities of periodic physical examination from the differing points

Continued on Page 59

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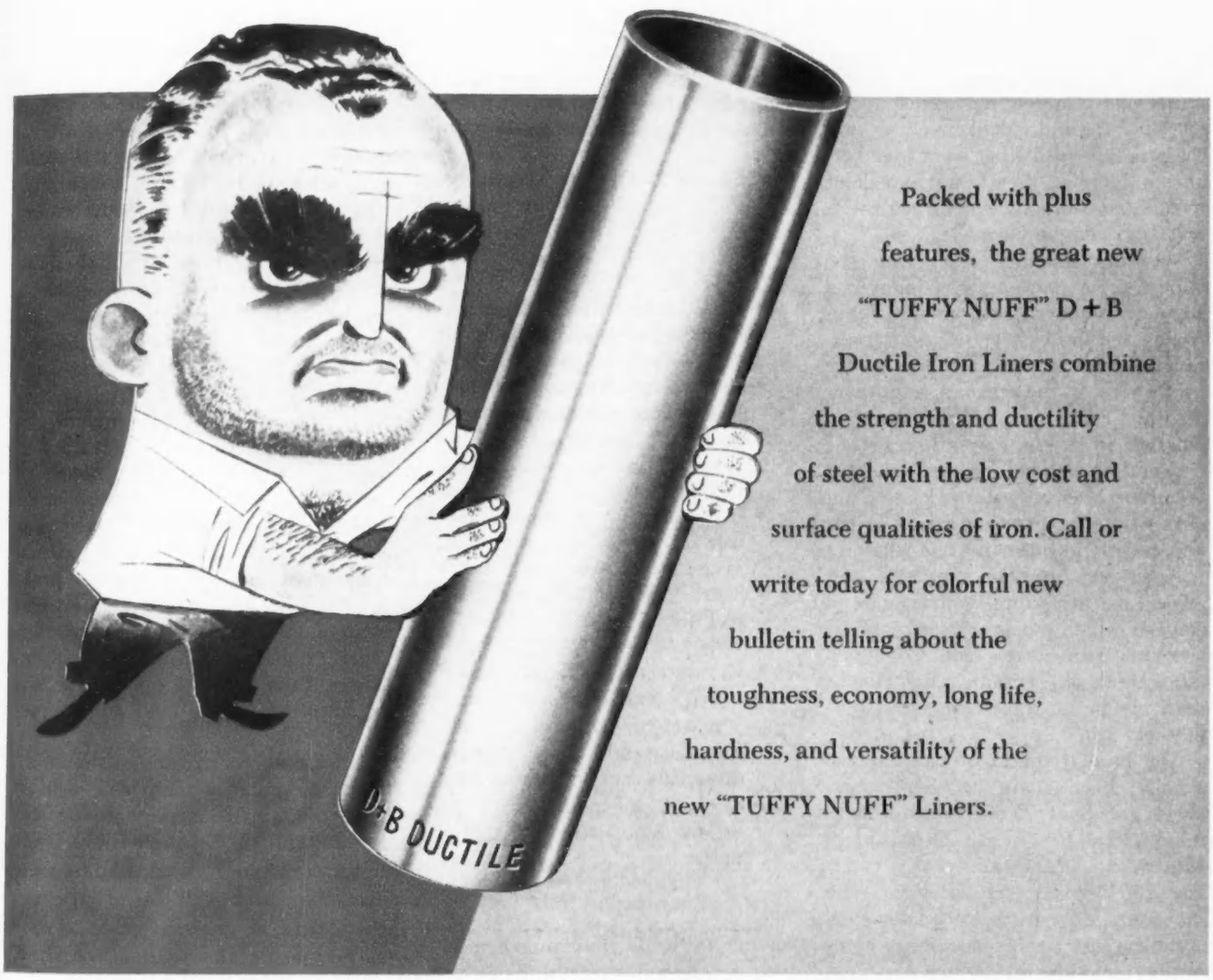

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How to Get Most Out of Your Meetings

Big money goes into conventions and conferences in American industry. They must be well planned and attendance must be purposeful if they are to yield the maximum benefits.

By IRVING LADIMER,
Washington, D. C.

GROUP THINKING and group action provide much of the impetus for American industry of today. Committees have largely replaced the lone operator, the individual inventor, and the attic scientist. Men work together, and in doing so, they find it expedient to hold conventions, committee meetings, and company conferences.

Working together and using the experience and example of many is a significant modern phenomenon, influencing the business world as it traditionally has molded activity in the professions, in the sciences, in governmental relations. The meeting, whether it be the committee or the convention, has become the accepted voluntary way of getting to know not only **who** (once considered to be the only payoff in business) but **what.**

American business grumbles and gripes at attending conclaves and confabs which eat into time, expense accounts and ulcers but would no more think of jettisoning this freight than giving up advertising and promotion.

The annual round of conventions, usually beginning in September, comes to about 75,000, according to the Federal Commerce Department. More than 12,000 are yearly meetings of industry associations, trade shows or conventions of professional organizations in business and commerce. Another 60,000 are company conventions of some size. Around 6 million a year attend these company get-togethers, including an increasing number of repeaters who show up at several a year.

By accepting conference attendance as serious business, it is only sensible to get the maximum benefit to the firm, the industry and to our economy generally. Some firms also have invested in full-time conventioneers, but most prefer to select executives suitable to the occasion. After all, they may want to see what's going on, and — of more importance — others want to see them, rather than the professional agent who is less likely to know or direct company policy.

What You Can Do . . .
To make the difference between a dud and a dynamic leader at a conference which calls for group action—

- Think. Contribute creatively to the action of your group.
- Encourage others—particularly the shy—to speak, accept jobs.
- Be objective, simple, brief in speaking and acting. Get to the core of the problem.
- Be loyal to the group. Serve it, not your personal interest.
- Be a team member. Help dislodge jealousy, destructive competition.
- Help establish a climate for free discussion, acceptance of ideas, translation into action.
- Listen. Accept proposals objectively, evaluate critically but positively.
- Show enthusiasm and support good ideas, wherever they come from.
- Introduce and follow system in discussion, action, evaluation.
- Keep on the track and guide others along the straight paths.

—adapted from *My Group and I* by Lippitt and Schmidt

Is It Necessary?—Let us begin from the beginning. In the case of a conference, that's well before the opening dates. It is assumed (perhaps without justification in some cases) that there is a definite need and purpose for the meeting. Other than the values of meeting new people, keeping up acquaintanceships, shopping for trade gossip, there should be primary goals evident. An industry may be faced with governmental restrictions or conversely, government demands for expansion; the threat of foreign competition; the problem of keeping pace with the general economy; acute specialized manpower shortages. A company at its annual convention may have specific problems which underlie sales issues: other-industry inroads, geographic market changes, technological impasses. It is important to know why the meeting will be held and to prepare for it.

Pre-Conference readiness should include assigning to those who will attend the job of intelligent two-way representation. On the basis of study of the conference agenda and its aims, executives and staff must present themselves as knowledgeable as well as personable ambassadors for their organizations. At the same time, they serve as eyes, ears and interpreters for those who remain at headquarters.

If a contingent is going, the latter function may be farmed out along lines of interest or responsibility. Not unusual is the detailing of day-by-day

orders to attend sessions, meet customers, fill in at the local office, file reports and act as host. This careful programming utilizes the full potential of each delegate . . . but overplanning may fail to permit the flexibility and rapid change which may be needed at an active gathering. Send sound, experienced men with good judgment and firm loyalty rather than second-raters with a train schedule.

At-conference participation obviously includes attendance or coverage of the main work sessions and committee actions. There is no substitute for on-the-spot listening and study of both speaker and audience. Even though the major addresses may be reprinted and available for later analysis, the delivery and immediate reactions of interest, surprise or disbelief cannot be captured from a stale report. If the convention uses operating committees, post-meeting studies and surveys as a means of linking annual sessions, steering and executive staffs for special problems, actual and not vicarious participation is imperative. Place your men on committees, have them ask questions and get answers, let them use all the facilities of group action and consideration to bring back information, trends, ideas.

Taking part also means keeping a finger on the conference pulse. Simply speaking, each representative should have an awareness of how things are going—where the lags are or may be coming; what changes should be made, in midstream if necessary, to clinch a resolution or decision; what reports are due. He must equally judge where stress and strain can be relaxed because things are well in hand. This kind of super-level participation calls for a conscious responsibility for getting things done and formulating plans for post-conference action.

Post-conference action is often neglected, though this is the payoff post. After all is said, there's work to be done. In general, three kinds of intelligence ought to be brought back from the conference front, as quickly as possible:

- Facts and figures presented at the meeting by outside specialists, industry or company men and colleagues from other firms.

- Impressions made, sales and contacts developed and leads to be run down by the firm.

- Evaluation and analysis of the meeting in terms of the particular issues facing the company.

A written report with appropriate underscorings for levels of management and departments, often demanded, is unquestionably desirable as a record for the future as well as of the past. It is a basis of action and planning.

A final aspect of the post-mortem should, as for royalty, hail the new as well as bewail the deceased. While the conference is still fresh in mind, ideas for the next agenda should be put into the hopper. If the meeting is to develop a program, and especially if each delegate is expected to help as well as hear, it is essential to begin thinking about the next go-round as early as possible.

Methods and Gimmicks—Conference planners and arrangers of the modern school are evident today, selling methods and gimmicks to make the convention move, the committee tick. Where beauties emerged from a frosted cake, now intricate mobiles, exhibits using appeals to all the senses and gadgets of all types are employed to snare attention. On the more serious level, however, the best of today's technology has been applied. Outstanding perhaps is the use of closed-circuit TV which allows simultaneous presentation to hotel rooms scattered over a city, and two-way hookups, right from the boss' office in the plant. Color will probably be used soon. The diorama and the moving model, largely used for scientific and professional display in the past, are now standard props in booths.

With all the best of electronics, art and movies, the surest method of achieving success is hard work in the tested techniques of sitting and seeing alertly. The conference must be regarded seriously and used fully, more as an informational and educational medium than a social whirl. Big money goes into meetings and, carefully invested, can yield considerable profit. —**The End**

Health Program

Continued from Page 52

of view of these groups. As a result it has been determined in General Petroleum Corporation:

Periodic physical examinations yield a net gain. A maximum number of workers are kept on the job at an optimum level of efficiency. Industrial accidents due to emotional upsets are fewer and workmen's compensation costs are reduced. The management obtains another channel of communications with employes and gets the benefit of the trained observation powers of medical men. The evidence of a true concern for the well-being of employes has been found to improve morale and to increase the acceptance of the company by the general public, creating a better reputation in the market place, increasing confidence among stockholders, and a more cooperative attitude from regulatory bodies. These "assets" more than offset the "liabilities" incurred by the company, chiefly the cost in time and effort.

To the employe, periodic physical examinations also yield a net gain. Examinations reassure healthy employes. Employes subject to organic disease receive information on these disabilities in time to seek treatment from their private physicians before irreparable harm is done. Experience has shown that many would not have received such information until serious symptoms appeared.

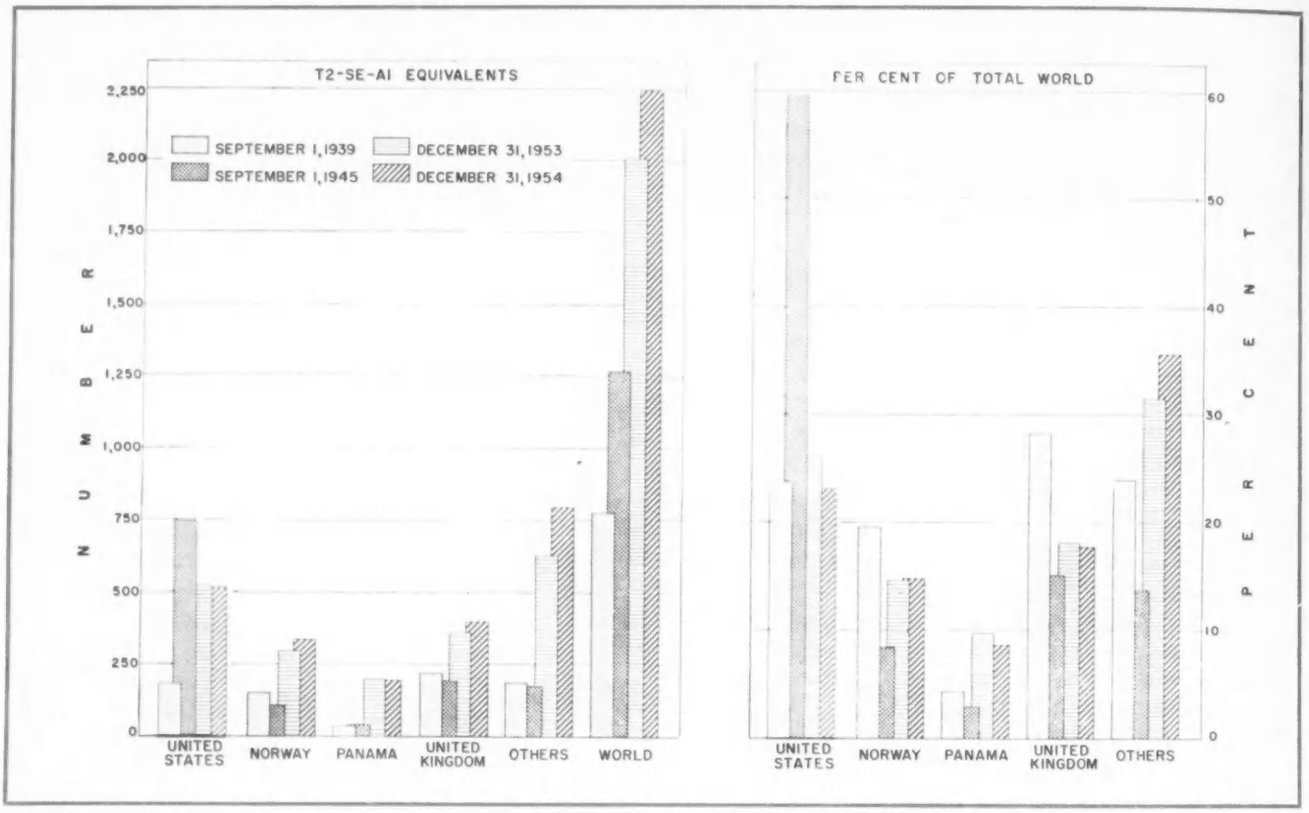
General Petroleum's experience has shown significant reductions in the incidence of heart disease, overweight, back disabilities, hernias, digestive tract disease, and in female malignancies.

In the field of mental health, the periodic physical examination has given employes assistance and counsel which often they hesitate to seek in a busy office of a private practitioner.

Employes lose less time at work through sickness and disability.

These "assets" more than offset the "liabilities" incurred by a few employes through periodic physical examinations. About 0.5 percent with disabilities of a temporary or permanent nature are affected in job security by information gathered through these examinations. Only a few employes develop a false sense of security after such examinations. Hypochondriasis is reduced. —**The End**

BRITAIN TO PASS U. S. IN TANKERS



Tank ship fleets of major flags on selected dates (ocean-going vessels 2000 gross tons and over).

- **U. S. led all countries with 23.3% of world capacity at end of 1954, while United Kingdom had 17.7%.**
- **But each will have about 19% on completion of vessels now under construction or on order, as U. S. builds few and U. K. many.**
- **U. S. builds bigger, faster, ultra-efficient supertankers in effort to compete with cheaper labor and lower operating costs of foreign flag tankers.**

THE U. S. rapidly is losing its lead over other countries in the ownership of tankers, and apparently will soon be displaced as the world's leader by the United Kingdom.

This prospect was revealed by the recently released annual analysis of world tank ship fleets made by the statistical research division of Sun Oil Company.

At the end of 1954 the U. S. had 525 tankers, still the largest tankship fleet in the world, but 25 less than a year earlier. The new total represented only 23.3 percent of the world's carrying capacity, compared with about

FILL YOUR CASING AUTOMATICALLY

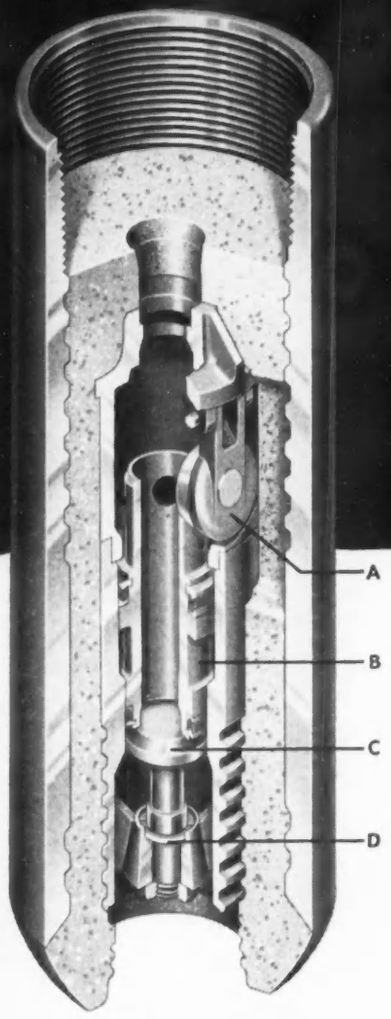
...from the bottom...while it's being run

with BAKER

• DIFFERENTIAL FILL-UP SHOES *and*
• DIFFERENTIAL FILL-UP COLLARS

Here's what DIFFERENTIAL FILL-UP Equipment does . . .

Permits the casing to *fill automatically from the bottom*, while it is being run, to within 90% of the fluid level of the annulus (using a shoe OR a collar)—or to within 81% of the fluid level of the annulus (using *both* a shoe AND a collar). In addition, a back-pressure valve is present to be used at the *discretion of the operator*, for "floating" or for cementing.



Baker DIFFERENTIAL FILL-UP Shoe, Product No. 1081.

A—Flapper Valve functions only at discretion of operator.
B—Sleeve Valve operates to control rate of flow and volume of "fill-up" fluid.
C—Sleeve Valve Seat.
D—Shear Ring is sheared. Flapper Valve now functions for floating or cementing.

Here's how Baker DIFFERENTIAL FILL-UP Equipment will aid you to avoid danger, increase rig efficiency, save valuable time and promote safety...

REDUCES THE DANGEROUS "RAM EFFECT" thus minimizing the hazard of breaking down a potential lost circulation zone.

SAVES COSTLY DRILLING MUD that might otherwise be lost to the formation due to the "ram effect."

MINIMIZES DAMAGE TO MUD CAKE on the wall of the hole. The majority of the fluid displaced as the casing string is lowered enters the casing instead of flowing up the annulus and causing possible damage to the mud cake.

REDUCES DANGER OF STICKING CASING by reducing to a minimum the "no-motion time" formerly required to fill casing at the surface—extremely important when running casing in directional holes or sloughing formations.

SAVES ONE-HALF THE RUNNING-IN TIME plus the proven advantages of Baker Floating Equipment, including a back-pressure valve for cementing.

KEEPS THE RIG FLOOR CLEAN AND SAFE by eliminating the messy spill-over and splattering of mud present when casing is filled at the surface.

Ask any Baker representative or office for this new 16-page illustrated brochure . . .

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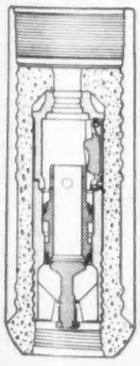
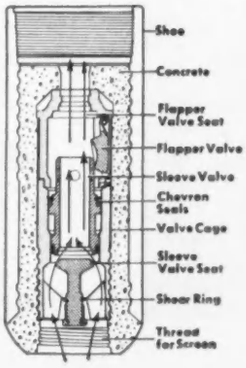
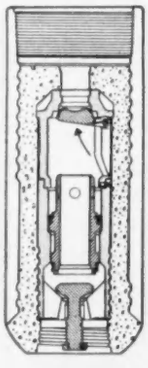


When running-in, the Sleeve Valve is in closed position in contact with the Sleeve Valve Seat. When the Sleeve Valve is in this position, fluid entry into the casing from below the valve is effectively blocked. The Sleeve Valve will be in the closed position whenever the height of the fluid column in the casing (the fill) EXCEEDS 90% of the height of the fluid column in the annulus.

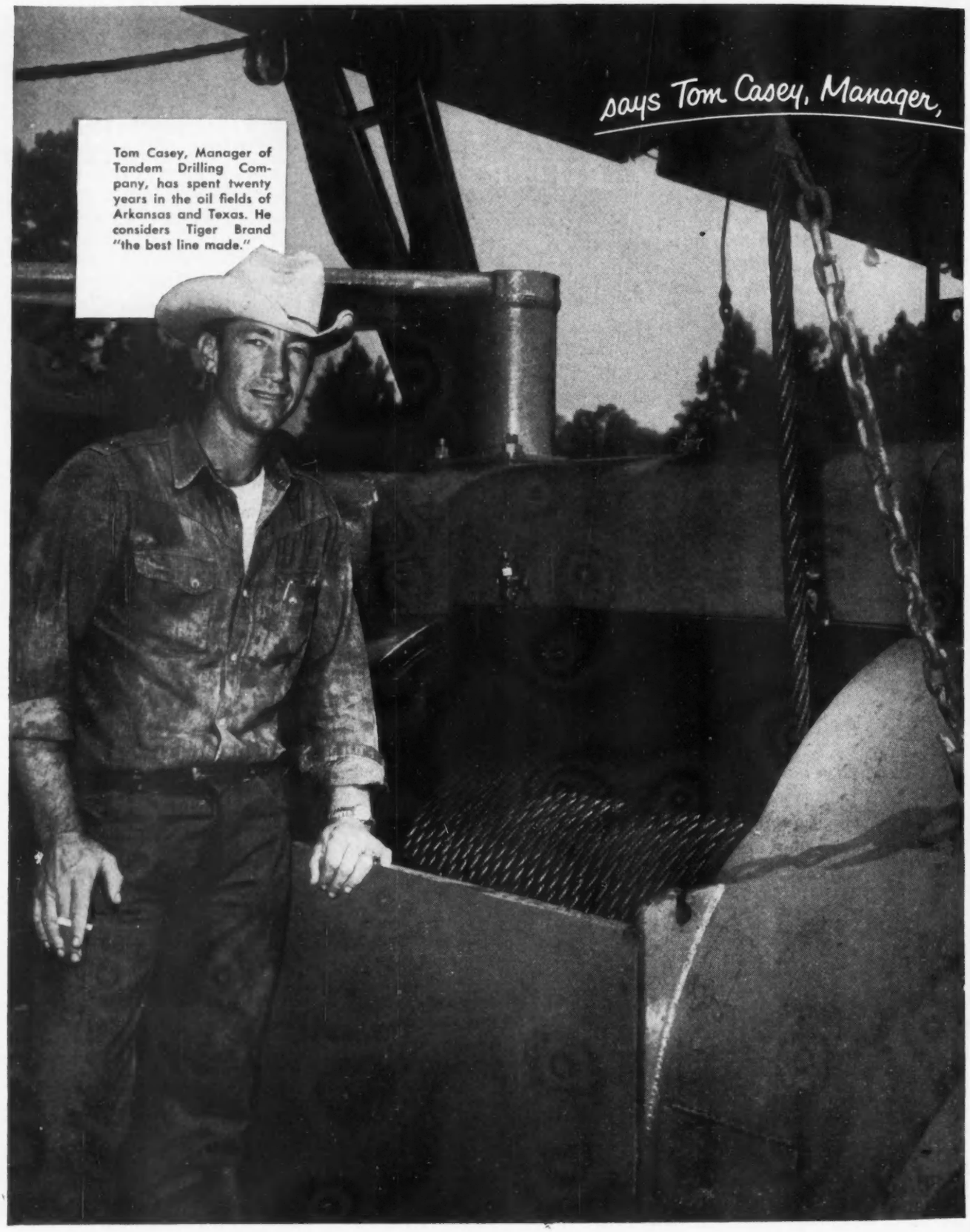


When the height of the fluid column in the casing (the fill) is LESS than 90% of the height of the fluid column in the annulus, the Sleeve Valve moves upward away from the Seat and permits fluid entry into the casing through the bottom of the FILL-UP Shoe. During the casing run, the Sleeve Valve opens and closes according to the pressures imposed on its top and bottom areas and thus automatically regulates the degree of fill.



When it is time for cementing, pressure of approximately 1,000 psi is built up in the casing to shear the Shear Ring that holds the Sleeve Valve Seat in the supporting vanes of the Valve Cage. The Sleeve Valve can then move downward sufficiently to release the spring-loaded Flapper Valve, and thereafter the FILL-UP Shoe functions as a conventional Float Shoe.

"Tiger Brand Line costs us


says Tom Casey, Manager,
Tom Casey, Manager of Tandem Drilling Company, has spent twenty years in the oil fields of Arkansas and Texas. He considers Tiger Brand "the best line made."

only 11.9¢ per ton mile

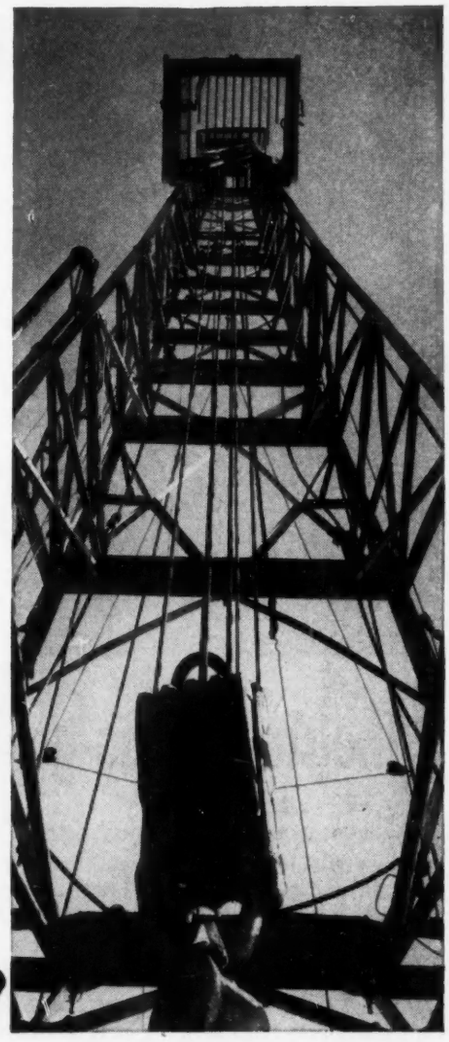
in Arkansas' East Schuler Field"

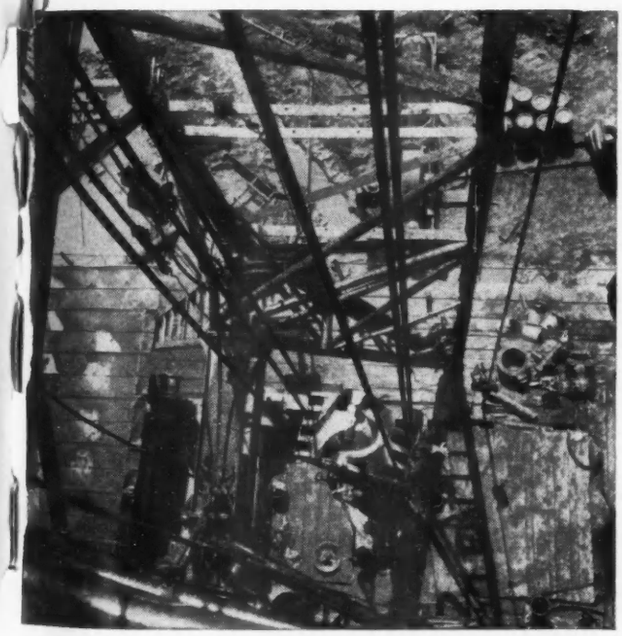
Tandem Drilling Company, Camden, Arkansas

53,550 feet of hole from a 1450-foot Tiger Brand Rotary Drilling Line—the equivalent of about *nine* average wells. Drilled at an average rope cost of less than 12¢ a ton-mile. Through sand, shale, limestone, sweet and sour gas, condensate, crude oil, salt water.

"We couldn't ask for better service," says Tom Casey. "We tried two competitive lines. But each one lasted only a third as long as this Tiger Brand Line. Now we use Tiger Brand exclusively."

If you want long lasting lines, *low cost* lines, do like Tandem Drilling Company—use Tiger Brand.





Tandem Drilling Company needs a line that can take a maximum stress of 120,000 pounds and give them a safety factor of 5 to 1, so this driller uses 1⅛" Tiger Brand *Excellay* Line with wire rope core.

This rig is going 24 hours a day. About every 1,000 ton miles the drilling line is cut-off to increase rope life. Tiger Brand is used for derrick, jerk, and tong lines, as well as drilling line.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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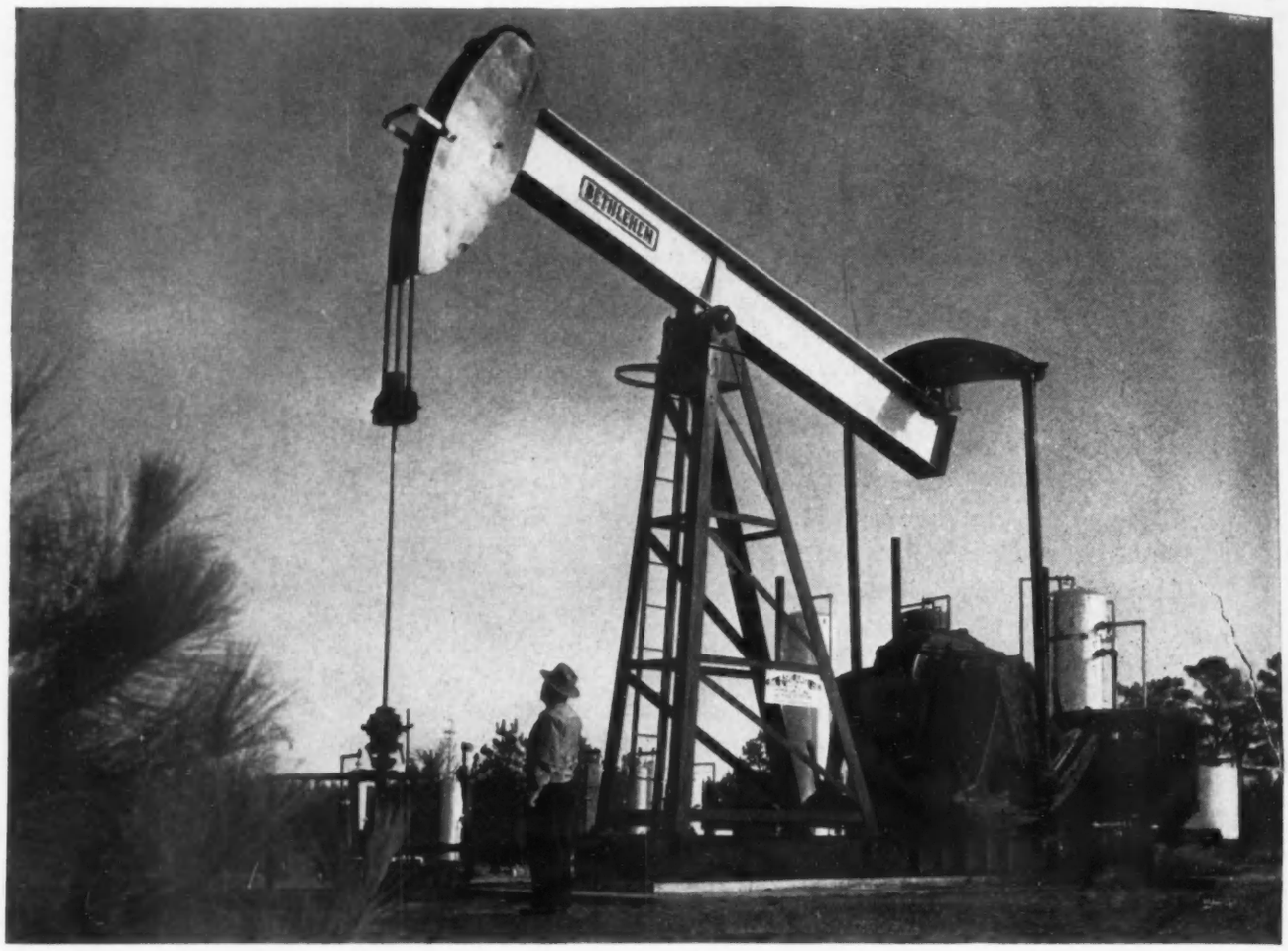


They're getting good rod performance in the Village Field

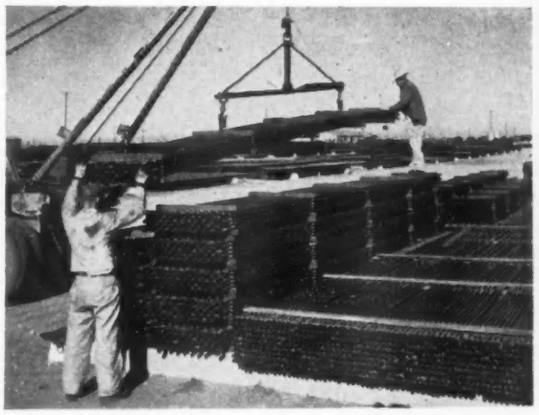
Talk about trouble-free rod performance! Here's a well which, going into its fifth year of production, has pumped approximately 300,000 bbl of fluid from Smackover Lime, without rod failure. It's the Bond Unit No. 1, one of many Ashland Oil & Refining Company wells in the Village Field, Arkansas. The pumping unit is a Bethlehem 320D-TC29. Operating around the clock at sixteen 72-in. spm, it raises 20 bbl of oil and 350 bbl of water daily. The string consists of 2200 ft of ⅞ in., and 3300 ft of ¾ in. Bethlehem "46" Sucker Rods.

The Bethlehem "46" rod is made of nickel-molybdenum steel. It is fully normalized and tempered, and is ideal for economical pumping in virtually every type of corrosive service. It is regularly furnished with carburized hardened-and-ground A4615 steel couplings.

To make it easy for you to obtain maximum efficiency from your sucker rod strings, Bethlehem produces carbon and alloy rods in four other types in addition to the "46." Your distributor will be glad to advise you about the best rod for your type of pumping operation.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



UNIT PACKAGE SAVES TIME AND TROUBLE

Bethlehem Sucker Rods save time because they come in a unit package of 80 or 100 rods. Each rod is held firmly by spacer grooves, preventing contact with other rods. The package absorbs shock, thus protecting the rods from damage. Unloading can be accomplished quickly by means of crane and lifting rig.

BETHLEHEM *Sucker Rods*

BETHLEHEM STEEL

The U. S. fleet alone, however, reflects a preponderance of vessels built during World War II and a deficiency of postwar additions

26 percent at the end of 1953. The past year's decrease continued the 9-year downslide from the high of 60 percent at the close of World War II.

This latest annual decline in carrying capacity left the U. S. in a position in the world-wide picture slightly lower than it occupied prior to the war. The United Kingdom ranked second at the end of 1954 with 17.7 percent of world capacity.

Statistics do not point to the possibility that the U. S. again will assume aggressive leadership, the analysts said. For there were only eight tankships under construction or on order intended for U. S. flag of registry at the end of 1954. That compared with 95 for Great Britain's flag.

Britain Gaining on U. S. The dimming future outlook for the U. S. and Britain's bustling growing prospects are shown clearly by a comparison of the two nations' existing fleets plus shipbuilding under way and orders on the books.

On completion of both programs, each will have about 19 percent of the increased world tanker fleet, with no indication on the horizon that the U. S. will halt its downward movement nor that Britain will stop climbing.

British shipyards at the year's end had 149 tankers on the ways or on order for their own account or for other nations, authors of the analysis said in announcing the survey. At the same time the U. S. had one foreign tanker building in addition to its own eight.

Another sharp contrast between the diminishing importance of the U. S. in the world tank ship fleet and that of other nations is pointed up by the analysts, who show that since 1945 the U. S. percentage of carrying capacity has declined nearly one-third.

Meanwhile, the British fleet has approximately doubled, that of Norway trebled and the Panamanian fleet quadrupled.

To compete with the cheaper labor and lower operating costs of foreign flag tankers, the analysts conclude in their announcement that American operators are turning to the big, fast and ultra-efficient supertankers—ships of 24,000 deadweight tons or larger.

They put this interpretation on the fact that tankers for U. S. registry under construction or on order December 31, 1954 averaged 27,500 deadweight tons, which was 5000 tons greater than the average of ships intended for the rest of the world.

World Fleet Larger. The world-wide inventory taken by Sun's analysts of ocean-going tankships of 2000 gross tons or larger shows 2602 vessels totaling 39 million (39,137,300) deadweight tons or 25.7 million (25,733,900) gross tons at the close of 1954. This was an increase of 100 ships from the fleet of December 31, 1953.

To supply a common denominator for widely-divergent ship sizes, capacities and speeds included in the survey, the analysts used the universally-known T2 (T2-SE-A1) tanker of 16,765 deadweight tons capable of cruising at 14.5 knots.

On this basis, the world fleet was equal to 2244 T2's on December 31, 1954—a gain of 240.5 T-2's or 12 percent from the fleet of 2,003.5 T2 equivalents in existence one year earlier.

Following the U. S., with its 23.3 percent of the world's tanker capacity at the end of 1954, leading flags of registry were the United Kingdom with almost 18 percent of the world fleet carrying capacity; Norway with almost 15 percent; Liberia with nine percent and Panama with just under 9 percent.

These five flags combined accounted for nearly three-fourths of the world's tankers when expressed in terms of T2 equivalents, with no other flag having as much as 5 percent.

The average speed of the world fleet at the end of 1954 was 13.9 knots, a gain of three-tenths of a knot from the December 31, 1953, average.

Construction Down. At the end of 1954 there were under construction throughout the world or known to be on order the equivalent of 590.4 T-2 equivalents. That was a decline of nearly 29 percent from construction activity a year earlier, which totaled 829.2 T-2's. The new tankers will average 22,300 tons in deadweight and 15.5 knots in speed. In size this is nearly half again as large as the average of the existing fleet and in speed an increase of 11½ percent. If these new tankers under construction or on order are added to the December 31, 1954, fleet, the resulting averages of size and speed nearly equals a T2-SE-A1 tanker.

The eight tankships under construction or on order intended for U. S. flag of registry at end of 1954 compared with 407 tankers destined for all foreign flages combined.

With the addition of construction and orders to the fleets existing at the end of 1954, U. S., Norway, Panama, and Great Britain will account for 63.2 percent of the world's tanker carrying capacity. This compares with 64.5 percent on December 31, 1954.

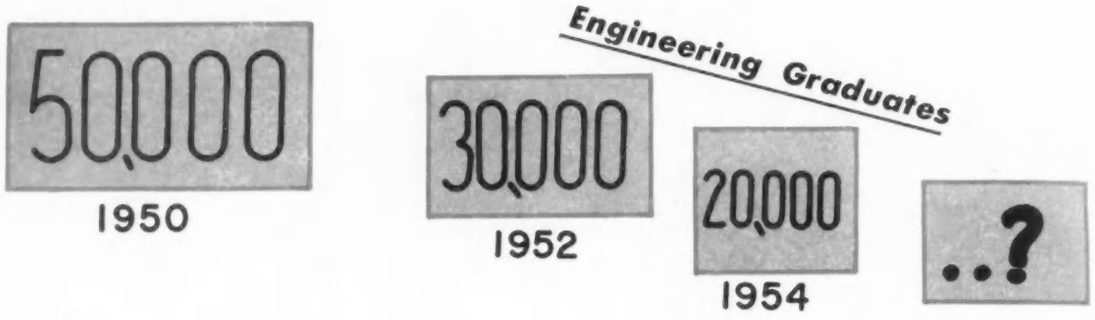
If 24,000 deadweight tons is selected as the lower limit of "supertankers," 17.8 percent of the carrying capacity of the world's tanker fleet is accounted for by vessels of this description.

Worldwide, the fleet at end of 1954 was well balanced with respect to age, if a useful life of 20 years is accepted as a basis for comparison. The U. S. fleet alone, however, reflects a preponderance of vessels built during World War II and a deficiency of postwar additions.

In 1954 there was a continuation of the trend of U. S. tanker owners placing their vessels under friendly foreign registry. Of 838.3 T-2 equivalents under U. S. control at end of 1954, nearly 38 percent were registered foreign. One year previously, this percentage was slightly more than 33½ percent, and on September 1, 1949, about 27 percent.

—The End

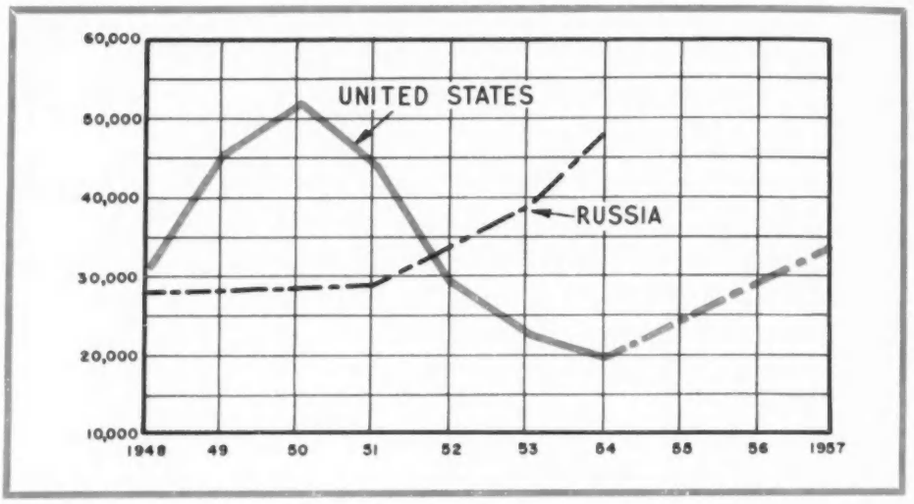
What happened to ENGINEERS...?



"We needed 50 engineers . . . We were able to hire seven—in seven months!"

—Report from one oil company

plus this



FOR THE MOST efficient use of our natural resources, for expansion of industry, and for our national defense, we need *more* technical specialists.

In this age of technology, one of the most important groups in our nation, from a standpoint of both the economy and national defense, is made up of engineers, chemists, physicists, and other technical specialists.

They enable us to transform a chunk of iron ore from a Minnesota range into a finely machined turbine for a jet aircraft which can launch man across continents at supersonic speeds. Technical specialists enable us to produce from crude oil either a crystal-clear plastic, high-octane gasoline, motor lubricant, or any one of many thousands of other products, according to our needs. Raw materials once considered almost worthless—like natural gas—are being put to very important uses; and we are learning how to eliminate waste and conserve our natural resources, all through the skills of technical specialists.

Without such technical specialists, no complex and highly technical organization could carry on its operations for long.

All these facts emphasize the importance to everyone of one more fact—America is not training nearly enough of these technical specialists to fill its needs.

Recently the Engineering Manpower Commission pointed out that the total national need for engineers alone is rising at five times the rate of population growth, or about 9 percent a year. On the other hand, the U. S. Department of Education estimates that this year's graduating engineers would amount to an increase of only 5 percent over 1954's class. Even this does not tell the whole story, for this discrepancy between supply and demand has been going on for several years. This year's graduating class of engineers was expected to number some 23,000, but it is estimated that somewhere between 45,000 and 75,000 new engineers are needed.

To every company which engages in highly technical operations, this shortage of technical specialists is of deep concern. One oil company which needed 50 new engineers reported that it was able to hire only seven within a period of seven months. Others reported little better luck.

Some leaders in industry have expressed the opinion that this shortage of technical specialists has reached a point where it is a threat to national security, for modern wars are fought at the very highest technical levels. The atomic and hydrogen bombs, radar, and guided missiles are only a few of the more obvious examples of weapons which require immense numbers of technical men for development, improvement, and actual use. The Russians are reported to be turning out more than twice as many engineers per year as we are currently.

ACKNOWLEDGMENT
Excerpt from *Lion Oil News*, June, 1955.

Mr. 'H' was excited...

Mr. H. was excited. He had the oil deal to end all deals. And he was no child when it came to such oil deals. It was a good deal. Mr. H. believed in its success for he had unbounded faith and optimism in his own ability to make it come out as he had planned. He had everything ready for us, and we could hardly keep him from signing right there and then.

We tried to slow him down, but he had the bit between his teeth and he was on the run. Finally we got him to listen, and we explained his deal to him from our point of view. We showed him the dangerous position he was needlessly putting himself in. Our faith in him was high, but we couldn't see a man put a noose around his own neck.

So we knocked off a lot of what he would have had to do. We brought his part down to what you could reasonably expect a man to do. We didn't lend him as much as he had wanted, but what we did lend him was fully adequate and on terms a great deal easier and more favorable to him than he had set up for himself.

We can do things like that because we know the oil business and we know the money business. Our advice is impartial and is based on a great deal of experience. So the chances are we can help you, too. That's why oil men ***going up*** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

THE NATIONAL BANK OF COMMERCE

OF HOUSTON

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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Facilities of the Oil Loan Department of The National Bank of Commerce are available in Wyoming, Colorado, Nebraska, New Mexico, Texas, Louisiana, and Mississippi.

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Refinery Runs Are Too High

EXCESSIVE REFINERY RUNS now threaten to mar the U. S. petroleum market outlook. If refining operations are permitted to continue at the recent high levels they will result in excessive supplies of distillate fuel oil and perhaps of gasoline.

The prospect that too much distillate fuel will be manufactured is of immediate concern. Sharp gains in recent months already have pushed distillate stocks to dangerous levels for this season of the year. Their rate of growth needs to be curtailed during the next three months.

Despite record output, high consumption has kept gasoline supplies below year ago volumes. However, high production in recent weeks has materially retarded the rate at which stocks are being reduced, and if continued will lead to difficulties.

Crude oil supplies, on the other hand, have shown considerable improvement recently, stocks having been reduced by substantial amounts during the past six weeks and are likely to continue downward during August.

•

REFINERY RUNS HAVE RISEN SHARPLY in recent weeks. During June crude runs to refinery stills were at a near peak of 7,508,000 barrels per day, up 225,000 barrels from May and 500,000 barrels greater than in April. Runs continued to advance during the first two weeks of July, reaching a peak of 7,619,000 barrels daily.

If such levels are continued during the next three months, both distillate and gasoline will be in excessive supply. Consequently, refinery runs need to be curtailed now, before supplies become excessive. This would leave U. S. markets in good condition.

•

TOO MUCH DISTILLATE production has resulted in stocks of this product increasing 46 million barrels since the end of March. Inventories of distillate on July 15 were 12 million barrels higher than at the corresponding period of 1954, but they had been only 2 million barrels larger than the previous year at the beginning of April. Distillate stocks will continue to grow through October.

The situation is not yet critical, but needs to be watched closely to keep it from becoming acute. Distillate stocks totaled 109 million barrels on July 15, and probably should not be permitted to exceed 145 million barrels by November 1. In the six weeks between June 1 and July 15, distillate inventories increased by 27 million barrels, an average of 640,000 barrels per day. Additions in future months should not exceed half of this amount, if distillate stocks are not to exceed a maximum of 145 million barrels by the first of November.

Thus it is indicated that refinery runs should not be continued at recent peak levels, and that yields of distillate fuel should be adjusted downward.

•

RECORD CONSUMPTION has kept gasoline supplies in good condition despite peak output. However, there were signs that trouble may be created unless refinery runs are reduced.

Motor fuel stocks on July 15 were 3 million barrels less than 1954 corresponding levels, but they had been 8½ million less at the end of May. During the four weeks of June, gasoline output was at a peak of 3,670,000 barrels per day but stocks still declined by 295,000 barrels per day during the month. However, production rose to a new record of 3,729,000 barrels daily during the first half of July and stocks decreased by only 106,000 barrels per day during the period.

Gasoline stocks need to be reduced by 250,000 to 300,000 barrels per day between July 15 and the end of September if they are not to be excessive at the start of the winter season.

•

IMPROVED CONDITIONS exist so far as crude oil supplies are concerned. Stocks on July 9 were down to 270½ million barrels, a decrease of 9 million barrels since the end of May and almost 15 million barrels below year ago levels. This is the result of curtailed producing allowables and high refinery runs. Further reductions in crude stocks are due in August, with Texas' allowable scheduled to continue at its low level of June and July.

Hence, curtailment of refinery runs would not hurt the outlook for crude oil, while preventing the creation of excessive distillate and gasoline stocks.

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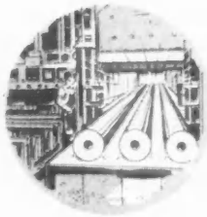
means lowest cost per foot of service!

Each Drill Collar is individually Trade Marked . . .

And each Drill Collar is individually Control-Numbered to insure Five points of superiority as outlined below . . .

restricted analysis of the steel



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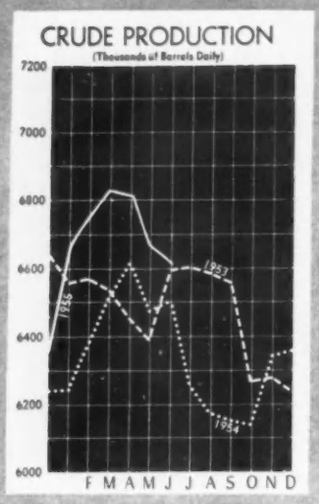
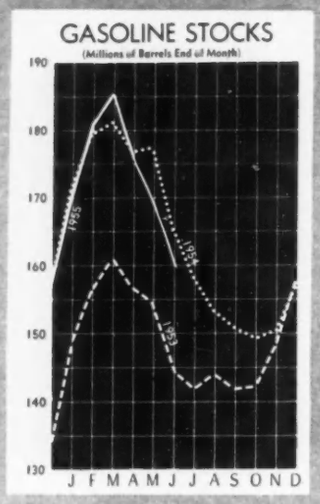
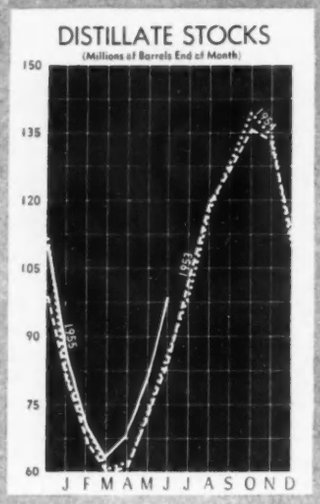
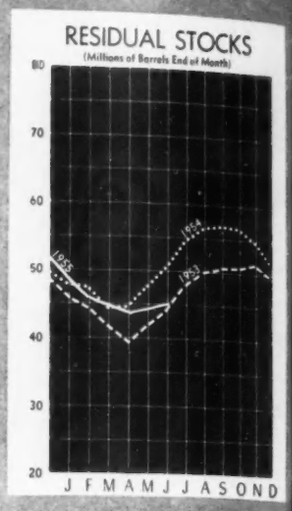
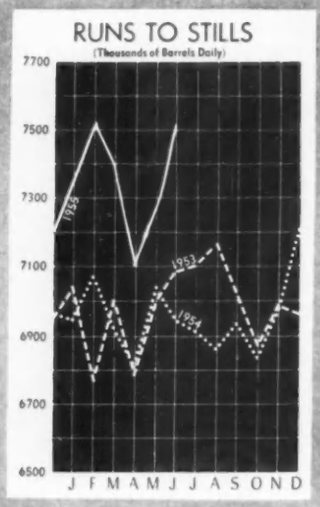
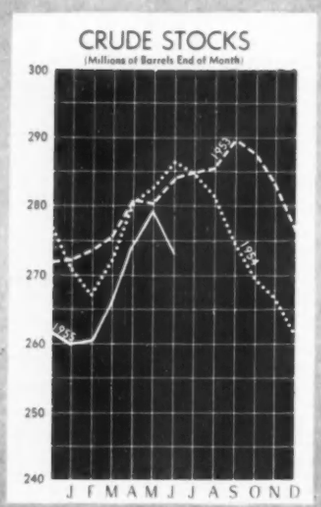












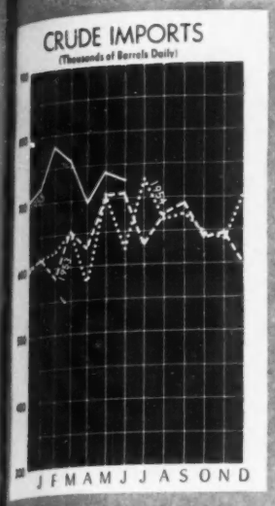
Petroleum Trends in U. S.

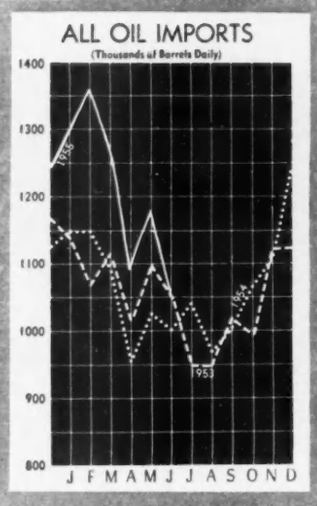
By **CECIL W. SMITH,** World Oil Staff

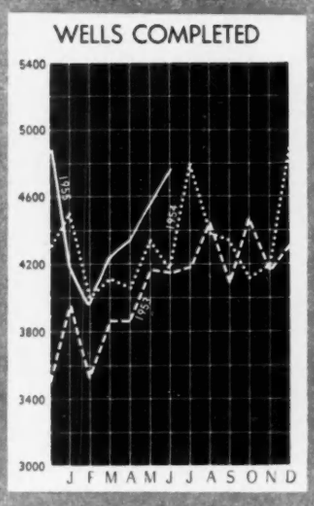
U. S. Crude Production by States

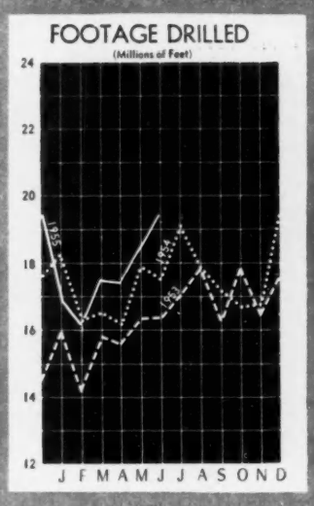
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION June, 1955	May, 1955	June, 1954	% Diff. June, '55-'54	TOTAL PRODUCTION First Six Months 1955	1954	% Diff. '55-'54
Alabama	3.6	3.9	4.4	— 18.2	670	813	— 17.6
Arizona							
Arkansas	75.2	74.4	82.0	— 8.3	13,969	14,726	— 5.2
California	969.3	973.8	978.4	— 0.9	175,535	179,067	— 2.0
Colorado	142.2	141.5	123.9	+ 14.8	23,332	19,248	+ 21.2
Florida	1.4	1.3	1.5	— 6.7	235	276	— 14.9
Illinois	232.2	222.4	189.2	+ 22.7	39,726	32,280	+ 23.1
Indiana	29.6	28.4	30.0	— 1.3	5,259	5,746	— 8.5
Iowa							
Kansas	312.1	312.1	336.4	— 7.2	59,929	59,492	+ 0.7
Kentucky	40.3	39.7	38.9	+ 3.6	7,141	6,742	+ 5.9
Louisiana	691.2	724.5	706.7	— 2.2	129,148	127,793	+ 1.1
North Louisiana	116.4	114.8	113.9	+ 2.2	21,193	20,930	+ 1.2
South Louisiana	574.8	609.7	592.8	— 3.0	107,955	106,863	+ 1.0
Michigan	31.1	32.2	34.1	— 8.8	5,757	6,072	— 5.2
Mississippi	98.2	96.8	92.0	+ 6.7	17,337	16,869	+ 2.8
Missouri	0.2	0.2	0.2		34	43	— 20.9
Montana	46.5	45.8	36.3	+ 28.1	8,114	6,236	+ 30.2
Nebraska	29.4	29.6	22.6	+ 30.1	4,534	3,517	+ 28.9
Nevada	0.2	0.2			35		
New Mexico	223.5	228.8	208.0	+ 7.4	40,378	36,571	+ 10.4
Southeast New Mexico	221.9	227.3	206.2	+ 7.6	39,947	36,203	+ 10.3
Northwest New Mexico	1.6	1.5	1.8	— 11.1	431	368	+ 17.1
New York	11.1	10.8	9.1	+ 22.0	1,638	1,648	— 0.6
North Dakota	28.8	15.4	13.5	+113.3	4,787	2,611	+ 83.3
Ohio	11.2	11.6	11.5	— 2.6	2,021	1,968	+ 2.7
Oklahoma	542.8	545.5	485.0		99,383	97,122	+ 2.3
Pennsylvania	22.0	21.1	26.4	— 16.7	4,012	4,772	— 15.9
South Carolina							
South Dakota	0.1	0.1	0.1		19	12	+ 58.3
Tennessee	0.1	0.1	0.1		7	9	— 22.2
Texas	2,776.6	2,808.5	2,787.9	— 0.4	531,439	496,214	+ 7.1
Dist. 1—South Central	53.5	54.1	44.0	+ 21.6	9,346	7,608	+ 22.8
Dist. 2—Middle Gulf	143.7	147.4	149.8	— 4.1	27,863	26,801	+ 4.0
Dist. 3—Upper Gulf	442.8	449.4	456.8	— 3.1	83,921	80,996	+ 3.6
Dist. 4—Lower Gulf-S.W.	235.6	237.5	252.6	— 6.7	45,290	45,677	— 0.8
Dist. 5—East Central	45.8	45.9	46.0	— 0.4	8,695	8,189	+ 6.2
Dist. 6—Northeast	328.0	335.6	353.4	— 7.2	64,234	64,146	+ 0.1
Dist. 7-B—North Central	140.9	139.2	119.4	+ 18.0	25,498	22,930	+ 11.2
Dist. 7-C—West Central	184.4	189.8	189.1	— 2.5	34,395	33,120	+ 3.8
Dist. 8—West	908.2	914.3	880.6	+ 3.1	171,896	156,889	+ 9.6
Dist. 9—North	205.1	207.6	192.6	+ 6.5	36,184	34,362	+ 5.3
Dist. 10—Panhandle	88.6	87.7	80.2	+ 10.5	15,751	14,820	+ 6.3
Utah	5.6	5.8	5.4	+ 3.7	1,003	960	+ 4.5
Virginia	0.1	0.1			10	4	+150.0
West Virginia	7.4	6.6	8.2	— 9.8	1,208	1,479	— 18.3
Wyoming	284.1	283.0	268.2	+ 5.9	49,459	45,501	+ 8.7
Total United States	6,616.1	6,664.2	6,500.0	+ 1.8	1,226,119	1,167,791	+ 5.0







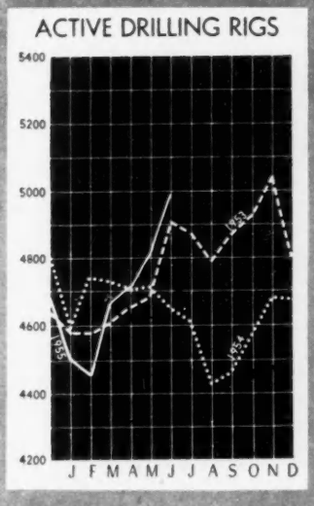


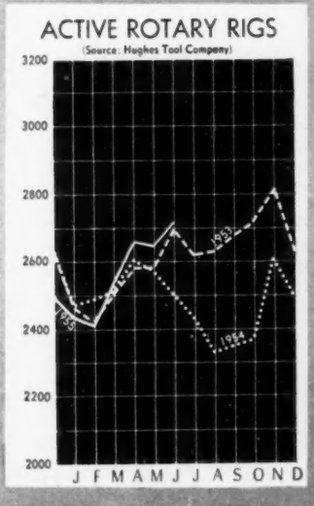
- **Active drilling rigs near peak**
- **Oil imports lowest in 9 months**
- **Crude output cut to year's low**

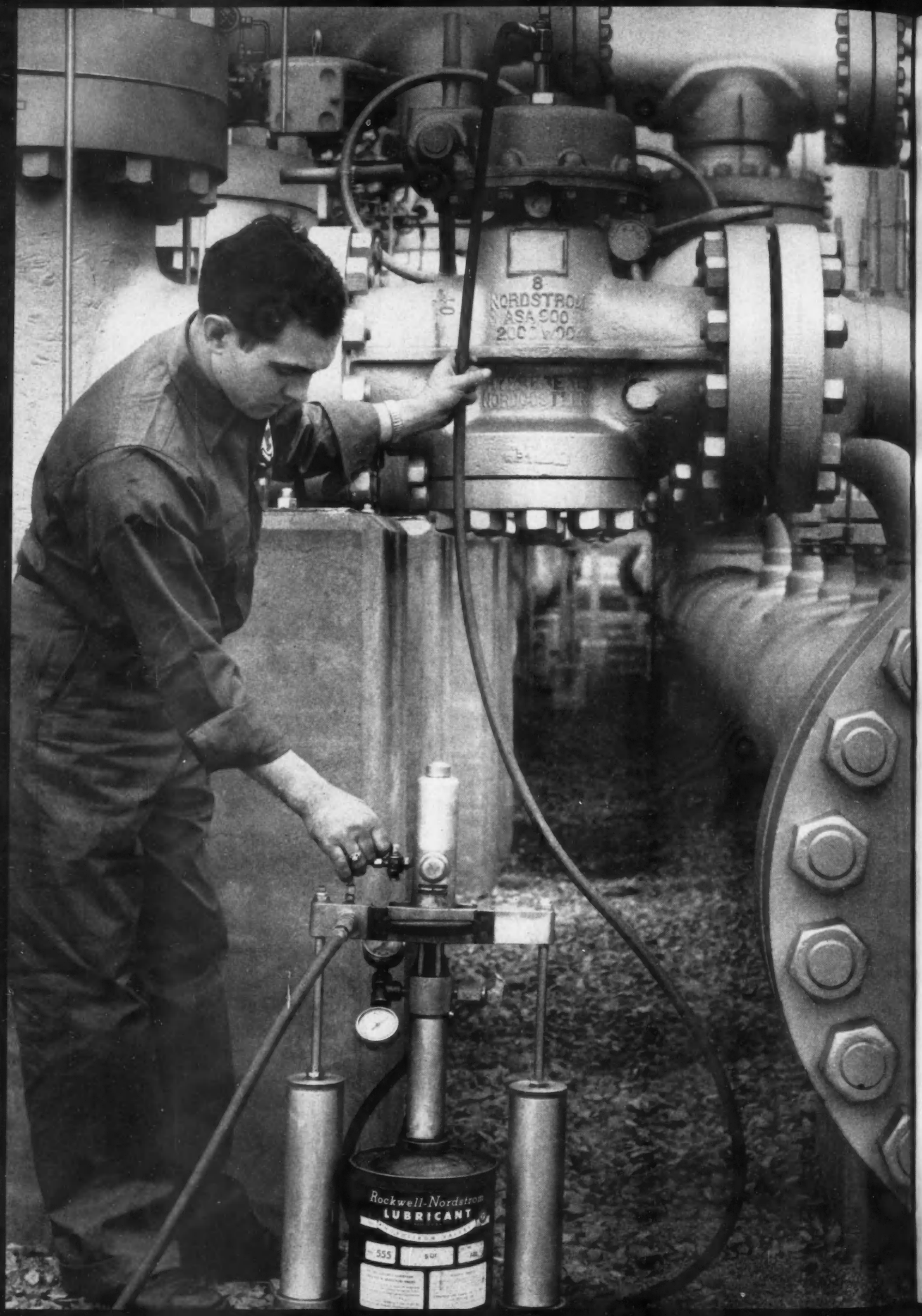
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL DUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1953:											
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,322	664	966
September	6,151	6,939	274,608	3,511	150,916	1,514	128,061	1,086	56,702	672	999
October	6,135	6,834	269,442	3,457	149,661	1,545	139,128	1,066	56,541	642	1,065
November	6,346	6,975	264,566	3,530	150,604	1,622	133,886	1,120	54,891	636	1,104
December	6,394	7,238	258,385	3,605	155,400	1,668	108,144	1,187	52,105	729	1,301
1955:											
January	6,761	7,379	260,156	3,639	169,562	1,740	86,692	1,235	49,457	739	1,348
February	6,835	7,549	258,630	3,655	181,643	1,847	68,513	1,239	46,042	751	1,379
March	6,886	7,374	264,430	3,543	183,972	1,703	62,457	1,185	44,970	742	1,319
April	6,887	7,136	275,232	3,502	175,601	1,534	70,139	1,110	43,838	697	1,123
May	6,664	7,276	279,812	3,500	169,150	1,514	81,981	1,116	44,243	746	1,118
June	6,616	7,508	273,338	3,670	160,305	1,640	99,461	1,124	44,911	728	1,049
June, 1955, Change:											
In Month	+48	+232	−6,474	+170	−8,845	+126	+17,480	+8	+668	−18	−69
In Year	+116	+561	−11,817	+187	−5,099	+241	+13,136	+1	+5,305	+104	+50
Week Ended											
7-15-55	6,626	7,582	268,815	3,675	158,822	1,595	108,932	1,165	45,482	662	971
7-16-54	6,298	6,969	277,748	3,405	161,786	1,441	94,794	1,128	53,355	673	979






Rockwell-Nordstrom
LUBRICANT

Rockwell-Nordstrom Valves Prove Lubrication Is The Cheapest Maintenance!

● LUBRICATION ELIMINATES METAL-TO-METAL FRICTION

—the major source of valve wear. As in your automobile engine, lubrication assures longer life and better performance. Pressurized lubricant also forms a remarkably leakproof seal between the plug and the valve body. This lubricant seal has proven far more effective than the uncertain metal-to-metal seal in ordinary valves where a tiny scratch means leakage . . . and eventually, expensive reseating.

Costly valve down time is practically eliminated with Rockwell-Nordstrom valves because lubrication stops trouble before it starts. The lubricant also hydraulically jacks the plug to eliminate stuck or jammed valves, assures *instant*, quarter turn operation.

● LUBRICATION IS FAST...EASY

Rockwell-Nordstrom valves can be lubricated either with a pressure gun directly through the standard Rockwell fitting or by unscrewing the fitting and inserting lubricant "sticks." Lubrication never requires valve down time because any Rockwell-Nordstrom valve can be lubricated under service pressure.

Like any lubricated mechanism, frequency of use and operating conditions are the determining factors in the lubrication schedule. In any case, the time it takes to lubricate a Rockwell-Nordstrom valve is an investment in trouble-free, long-life valve service.

● LUBRICATION PENNIES SAVE MAINTENANCE DOLLARS

A few cents worth of lubricant buys three things: 1. *new seats* (renewing the lubricant is like reseating an ordinary valve) . . . 2. *smooth, dependable operation* and . . . 3. *savings* in terms of lower repair, replacement and down time expenses. It is not the cost of the lubricant that is important, but the *savings* through longer, more dependable life of the working parts and better performance.

● GENUINE ROCKWELL-NORDSTROM LUBRICANTS are specially compounded to not only reduce friction, but also to create a positive, leakproof seal. They are the result of 40 years of production "know-how" and field testing by the pioneer lubricated plug valve manufacturer. Their sole purpose is to insure that Rockwell-Nordstrom valves give you the best valve service you've ever had. That's why it's good business to use *only* genuine Rockwell-Nordstrom lubricants in Rockwell-Nordstrom valves.

● 40 YEARS OF PERFORMANCE PROVE that Rockwell-Nordstrom valves are the most economical valves you can buy for *any* service. Over the years, the sale of repair parts has been less than one-half of one per cent of Rockwell-Nordstrom valve total valve sales . . . *for every two dollars users spend on Rockwell-Nordstrom valves, they spend less than one penny for repairs.*

Whatever your needs, there is a Rockwell-Nordstrom valve that will do the job with more trouble-free dependability and at lower cost per year than any other valve you've ever used. And the first cost of Rockwell-Nordstrom valves is no more (and often less) than the cost of ordinary valves! For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

U. S. Wells Completed in June and First Six Months, 1955-1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR JUNE: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	TOTAL NEW WELLS: June, 1955	May, 1955	June, 1954	Total Footage June, 1955	DETAILS FOR JANUARY-JUNE: NEW WELLS: 1955	1954	Percent Diff.	FOOTAGE: 1955	1954	Rigs in Operation: June 30, 1955	May 31, 1955	June 30, 1954
Alabama				1				1		6	3,529	28	43	— 34.9	119,305	220,200	5	4	7
Arizona										6		4	8	— 50.0	16,136	30,774	1		3
Arkansas	33			16				49	80	48	158,600	331	269	+ 23.0	1,079,804	969,140	63	39	30
California	147		12	48				207	220	190	1,053,151	1,215	1,274	— 4.6	5,931,216	5,752,327	233	245	198
Colorado	41		7	87				135	129	118	718,965	716	630	+ 13.7	3,857,283	3,494,780	96	89	73
Florida				3				3	2	2	23,443	17	15	+ 13.3	106,664	97,343	6	3	3
Georgia													3	—100.0		11,068			3
Idaho												2			7,305		1		1
Illinois	202		2	157				361	256	238	871,066	1,700	1,428	+ 19.0	4,104,932	3,514,764	345	303	258
Indiana	9		1	31				41	51	66	67,064	260	390	— 33.3	408,327	594,670	93	100	124
Kansas	197		43	162			4	406	409	342	1,464,577	2,280	2,028	+ 12.4	8,329,597	7,085,677	462	498	405
Kentucky	62		15	70				147	119	110	231,421	717	672	+ 6.7	1,184,570	1,282,991	123	117	106
Louisiana	217	27	9	103				356	369	349	2,439,946	2,019	1,685	+ 19.8	12,691,696	10,737,361	384	390	268
North Louisiana	108	8	7	44				167	209	167	570,098	1,043	863	+ 20.9	3,041,556	2,533,530	90	76	53
South Louisiana	109	19	2	59				189	160	182	1,869,848	976	822	+ 18.7	9,650,140	8,203,831	294	314	215
*Gulf of Mexico	22	1		9				32	28	34	295,928	155	106	+ 46.2	1,434,879	970,813	47	52	
Maryland																	7	5	3
Michigan	15		1	31				47	41	46	152,165	250	280	— 10.7	742,252	748,257	101	85	108
Mississippi	14	2		26		1		43	38	40	306,719	243	193	+ 25.9	1,812,731	1,347,278	37	42	40
Missouri				4				4	3		2,032	24	6	+300.0	13,095	8,133	4	4	1
Montana	15			8				23	28	36	114,714	138	182	— 24.2	711,688	704,559	52	37	30
Nebraska	27			53				80	84	45	449,573	363	183	+ 98.4	2,083,776	1,017,438	58	49	23
Nevada				1				1	1	6	8,300	6	8	— 25.0	44,828	40,095	1	1	3
New Mexico	88		52	25				165	173	87	707,914	811	543	+ 49.4	3,451,498	2,999,354	160	165	135
New York	17				11			28	28	37	38,662	163	315	— 48.3	225,255	472,362	42	49	80
North Dakota	13			6				19	24	26	137,906	115	123	— 6.5	840,228	862,737	24	19	39
Ohio	60		15	21				96	101	82	193,140	533	514	+ 3.7	1,122,419	1,003,641	206	206	186
Oklahoma	430	5	22	188	9		4	658	677	513	2,307,370	3,607	4,034	— 10.6	12,268,185	13,762,895	664	644	742
Oregon				1				1			7,101	1			7,101		2	1	
Pennsylvania	18		15	8	13	5		59	55	84	121,539	352	570	— 38.3	672,233	998,708	112	110	184
South Dakota				2				2		4	11,541	6	14	— 57.2	35,579	79,247		2	2
Texas	996	45	43	622	4			1,710	1,564	1,513	7,471,975	9,460	8,917	+ 6.1	41,554,181	40,756,022	1,393	1,326	1,329
Dist. 1: South Central	100	1	1	54				156	155	79	380,824	880	505	+ 74.3	2,336,132	1,732,566	49	52	37
Dist. 2: Middle Gulf	18	6	4	34				62	72	56	363,024	394	408	— 3.4	2,366,395	2,418,558	44	38	40
Dist. 3: Upper Gulf	69	7	11	68				155	146	148	943,420	874	855	+ 2.2	5,610,789	5,881,465	127	127	139
*Gulf of Mexico									1			7			70,548		3	3	
Dist. 4: Lower Gulf-S.W.	50	14	8	60	1			133	105	107	708,923	690	740	— 6.8	3,615,759	3,851,697	95	68	79
*Gulf of Mexico									1			7			63,743		3	2	
Dist. 5: East Central	6			11				17	22	37	58,421	137	137		554,610	502,042	18	13	17
Dist. 6: Northeast	31	11	6	29				77	59	63	395,338	332	360	— 7.8	1,811,763	2,162,924	66	66	52
Dist. 7-B: North Central	125		3	116				244	197	180	856,194	1,484	1,302	+ 14.0	4,580,012	4,314,128	168	157	134
Dist. 7-C: West Central	56		1	35				92	107	120	494,103	613	655	— 6.4	3,326,600	3,350,986	130	134	139
Dist. 8: West	264			77	2			343	297	218	1,847,260	1,813	1,434	+ 26.4	9,826,995	8,571,074	392	380	363
Dist. 9: North	222		3	132	1			358	312	414	1,148,497	1,742	2,026	— 14.0	5,778,181	6,337,146	230	220	232
Dist. 10: Panhandle	55	6	6	6				73	92	91	275,971	501	495	+ 1.2	1,746,945	1,633,436	74	71	97
Utah	3		1	6				10	3	6	48,187	48	24	+100.0	234,603	121,086	25	17	22
Washington																			1
West Virginia	3		40	9				52	42	44	130,216	288	246	+ 17.1	767,545	683,776	187	184	160
Wyoming	21		2	26				49	66	117	252,381	341	643	— 47.0	1,706,081	3,352,708	110	82	89
Total United States	2,628	79	280	1,715	37	6	8	4,753	4,563	4,161	19,193,197	26,038	25,240	+ 3.2	106,130,113	102,749,391	4,997	4,816	4,656
Total Western Canada	135		4	59				198	113	124	816,967	1,085	905	+ 20.0	4,701,096	3,729,449	183	144	137

*Gulf of Mexico wells are included in their respective district totals.

Wells Reach Mid-Year Peak

26,038 total tops '54 mark by 3.2 percent

ADVANCING U. S. drilling rates resulted in a high of 4753 new wells during June, topping the previous month's by 190 tests, and boosting the year's first-half total to 26,038. That aggregate was 798 wells, or 3.2 percent, more than the previous all-time high of 25,240 drilled in the first six months of 1954.

The year's drilling activity got off to a somewhat slower start than did 1954's, but the past several months has seen operations gather momentum. The number of drilling rigs active in the nation and the resulting wells have been steadily increasing. At the end of June, active drilling rigs had reached their highest point since late 1953, and wells completed in June were almost at the highest level in history.

At present, there seems to be no room for doubt that 1955 will go into the records as the greatest drilling period in the industry's history. The best measure of drilling effort expended is the amount of hole cut. And in this department, the nation's drillers topped last year's record slightly more than they did in the number of wells. In six months, total footage drilled amounted to 106,130,113 feet. That figured 3.3 percent more than the 102,749,391 feet recorded in the first-half of 1954. Average depth per well has changed little in the two periods. This year to date, each well was taken to the depth of 4076 feet on the average, while a year earlier the average had been a slightly shallower 4071 feet.

Only one of the top five drilling states experienced a decline in activity in the first-half of the year; that being Oklahoma where wells drilled dropped 10.6 percent from last year. However, the number one state, Texas, saw operations increase 6.1 percent, and the number three area, Kansas, gained 12.4 percent. Even larger hikes occurred in Louisiana and Illinois, where drilling was up 19.8 and 19.0 percent, respectively. Those states now occupy fourth and fifth place in the nation.

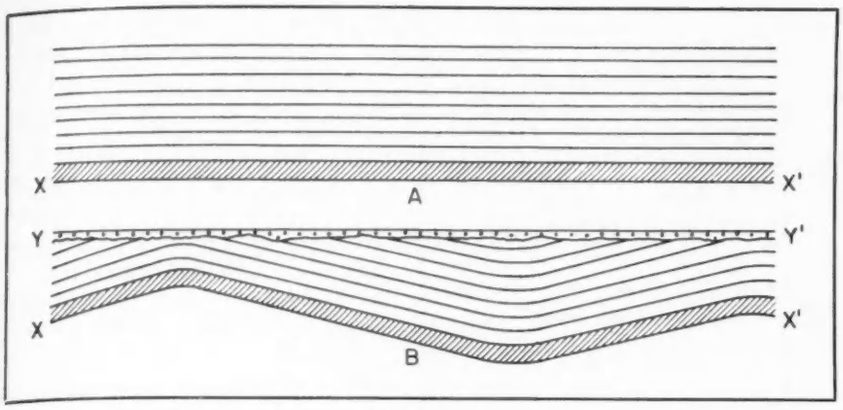


FIGURE 1

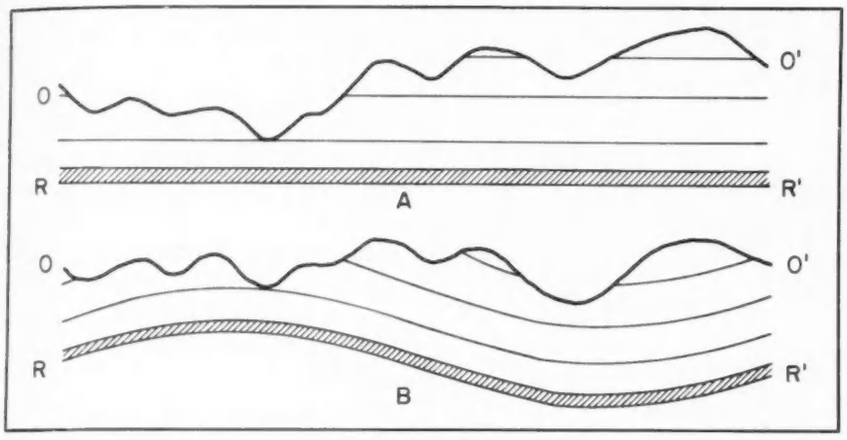


FIGURE 2

Thickness Maps Can Reveal Mid-Continent Structures

Isopachous maps showing great thicknesses of rocks have revealed structural movements in Rocky Mountain District. They also can reveal milder structural warpings of Mid-Continent, where rock sequences are thinner and deformation is of lower order.

By WALLACE LEE

ISOPACHOUS MAPS involving great thicknesses of rocks have been used for some time to reveal structural movements in the Rocky Mountain region. They are equally useful in determining the milder structural warpings of the Mid-Continent region where rock sequences are thinner and deformation is of a lower order.

Evaluation of such structural movements of the Mid-Continent region, however, is attended by some difficulties involving refinements of subsurface stratigraphy, such as topographic relief on truncated surfaces and local channeling. These factors are of secondary importance in the western regions where the sediments are thicker and deformed by much stronger structural movements.

This article is intended to call attention to the application and limitations of thickness maps in determining regional deformation especially in the mid-continent.

Structural interpretations. If an originally flat surface, such as X-X′ of Figure 1A, is covered by younger rocks which are later folded and beveled by erosion to the surface Y-Y′ of Figure 1B, the variations in the thickness of the rocks between the two surfaces will obviously reveal the place and the amount of folding. The thin areas represent anticlines and the thick areas represent synclines.

Thickness maps, which are three dimensional, are structural maps if, as in the cross sections, the limiting surfaces were originally flat and horizontal. Such maps show the structure of the surface X-X′ at the time of Y-Y′.

Flat surfaces that limit the sequence may be sedimentary surfaces like X-X′ or the result of erosional beveling such as Y-Y′. It is obvious that thickness maps will not reveal structural movement with mathematical accuracy unless both upper and lower surfaces were originally geometrically flat and horizontal. Such surfaces are, of course, rare although they were at times approached on sedimentary beds, especially evaporites.

When both limiting surfaces were depositional like X-X′, thickness reveals the structure with a high degree of accuracy. When one or both of the surfaces were erosional, accuracy with which the structure is revealed by thickness lines depends upon how closely the surfaces originally approached conditions of flatness and horizontality. If the topographic relief is relatively high the thickness may reveal only generalized structure over broad areas.

The following refers especially to regional structure. Horizontal distances represented in the diagrams may be assumed to be from 50 to 100 miles.

In Figure 2A, the line O-O′ represents a deeply eroded surface. A thick-

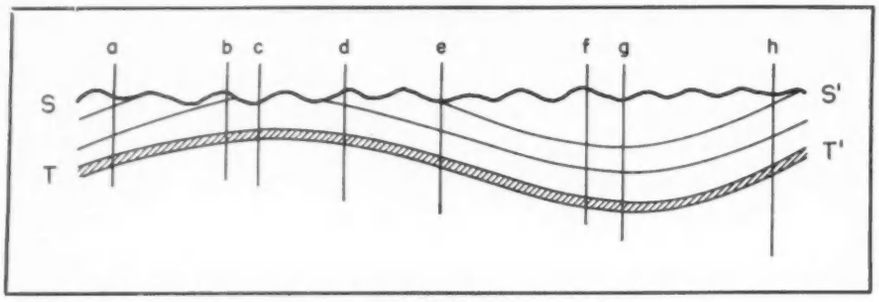


FIGURE 3

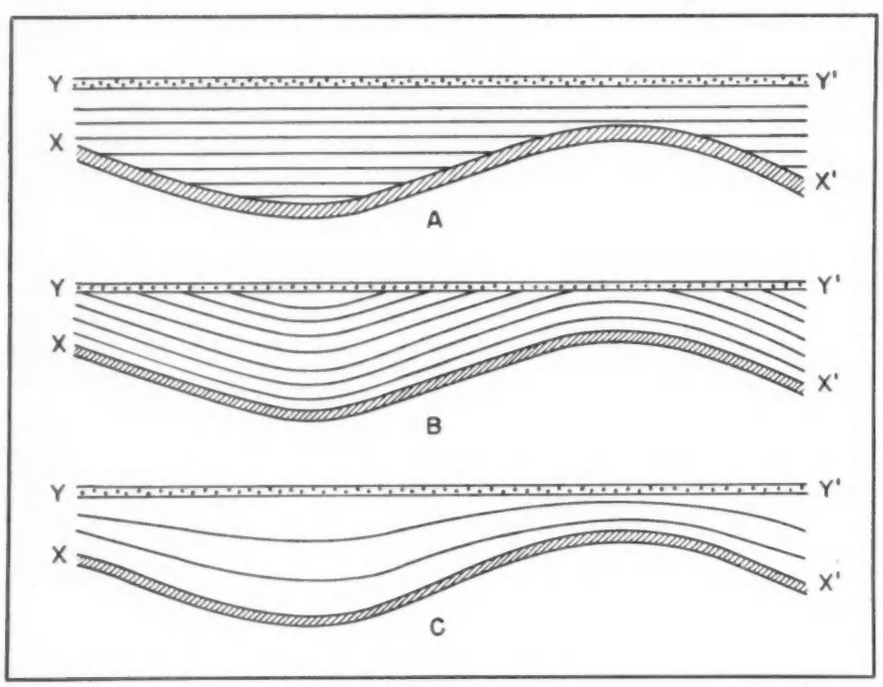


FIGURE 4

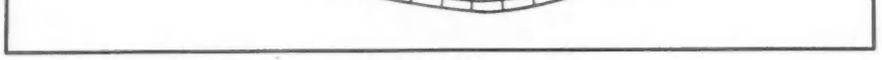


FIGURE 5

ness map of the interval O-R will represent the topography of the surface O-O′ and not the structure. In Figure 2B, which represents the same sequence after folding, the deformation during the interval cannot be determined by a thickness map because one of the surfaces did not even approach a horizontal plane. Such a surface occurs at the base of the Mississippian Cowley formation of Kansas.

Under conditions represented in Figure 3, erosional relief of the surface S-S′ is small when compared with the regional deformation. Regional structure will be revealed in general terms by a thickness map of the interval S-T. The vertical lines represent wells that have penetrated the sequence at high and low points of the eroded surface. Use of these wells in drawing isopachs will give a distorted impression of the local structure but will represent approximately the regional deformation. The Devonian rocks in Kansas, which overlie a surface with a local relief of as much as 80 feet, is an example.

Imperfections of eroded surfaces generally prevent their use in small areas, although some erosional surfaces like that of the Mississippian in Kansas were so nearly flat that thinning of the Mississippian limestones occurs on the crest of even low local anticlines in eastern Kansas.

Although thickness maps may reveal the place and amount of folding, they do not reveal sequence of events nor time of folding. Figure 4A represents the deformation of the original flat lower surface as having developed before the deposition of the overlying sediments. Figure 4B represents folding and beveling of the rocks as having occurred at the end of the sequence of deposition. Figure 4C represents the deposition of a sequence of rocks that was being deformed more or less contemporaneously with deposition. In C, both the upper and lower surfaces are depositional.

The thickness maps in all three of these examples are identical and reveal only the place and amount of deformation. To discover sequence of events it is necessary to determine the stratigraphic relation of the section involved to the overlying and underlying rocks by the construction of such cross sections as those shown.

It should be recalled that most structural deformation probably took place by differential and oscillatory movements, such as are so clearly revealed by the cyclical deposits of the Pennsylvanian. The conditions represented by Figure 4A and 4B would be modified by such differential movements during the period of deposition.

Examples illustrated by Figure 4 are not hypothetical. Diagram A roughly illustrates the character of the deformation between the top of the Mississippian and the base of the Kansas City when the beveled surface at the top of the Mississippian in Kansas was deformed before the region was submerged in the Pennsylvanian sea. Diagram B roughly illustrates the character of the deformation between the top of the Simpson and the base of the Devonian when folding and beveling occurred mainly

at the end of the sequence. Diagram C illustrates conditions that prevailed in Kansas during the Pennsylvanian when differential warping was more or less contemporaneous with cyclical deposition.

Figure 5 shows the progressive deformation of a syncline interrupted by an angular unconformity that resulted in topographic relief represented by V-V'.

Thickness of rocks between U-U' and W-W' records the total of many differential movements during the deposition of the sequence. The movements that occurred during the hiatus at V-V' which were in the same pattern of folding as those above and below are included in the total folding expressed by the over-all thickness. Such a sequence occurs between the top of the Topeka limestone of late Pennsylvanian age represented by W-W', and the Cottonwood limestone of early Permian age in Kansas, represented by U-U'.

The line V-V' represents the unconformable contact, much exaggerated, between the Pennsylvanian and Permian strata.

A more complex situation results when the sequence mapped includes formations warped by conflicting structural movements. Figure 6A represents a sequence of rocks that was originally horizontal but later deformed and beveled to the surface M-M'. This surface was later buried beneath horizontal sediments which were finally warped by a new and different pattern of folding and subsequently beveled as represented in Figure 6B. The later folding greatly altered the original structure below the surface M-M'.

In Figure 6C, an anticline appears in the center of the line N-N' as a result of the two conflicting patterns of deformation. In the subsurface this anticline occurs neither in its original position as in A nor under the anticline in the surface rocks as in B.

Something like this happened when the westerly trending Chautauqua arch which was developed in southeastern Kansas between Simpson and Mississippian time was crossed at right angles in early Pennsylvanian time by the northerly trending Cherokee basin syncline. The present attitude of the Pennsylvanian rocks in

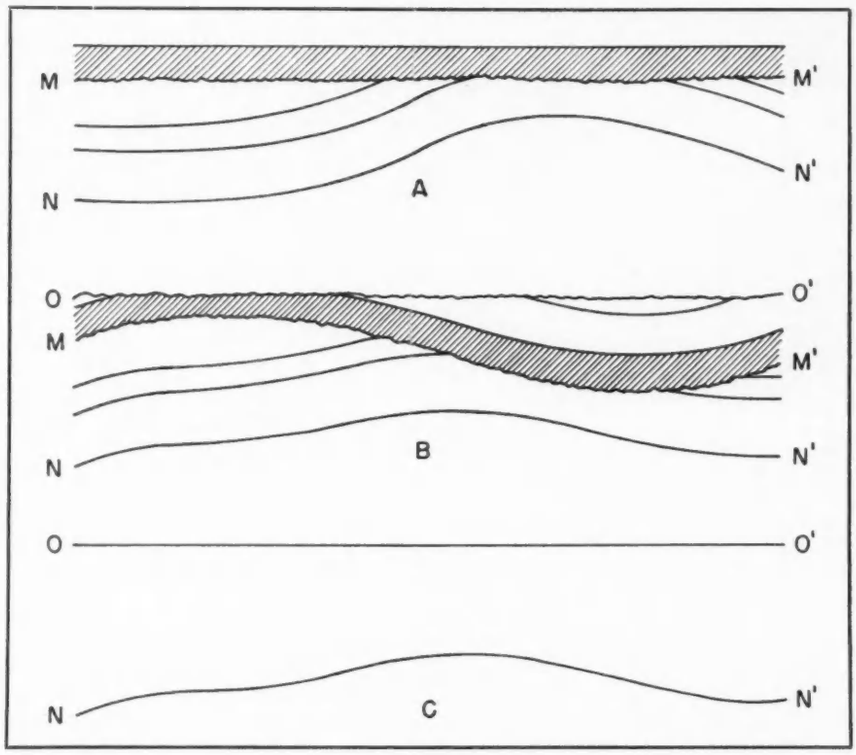


FIGURE 6

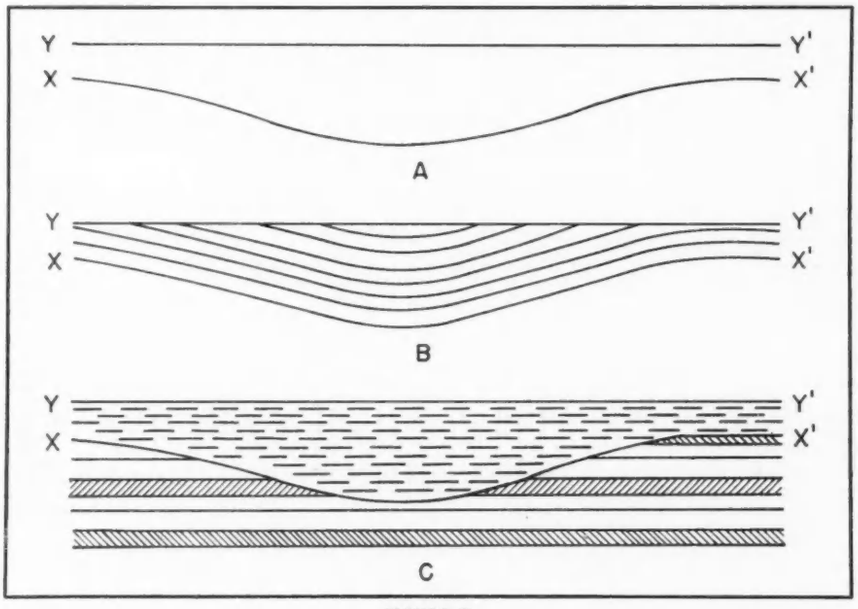


FIGURE 7

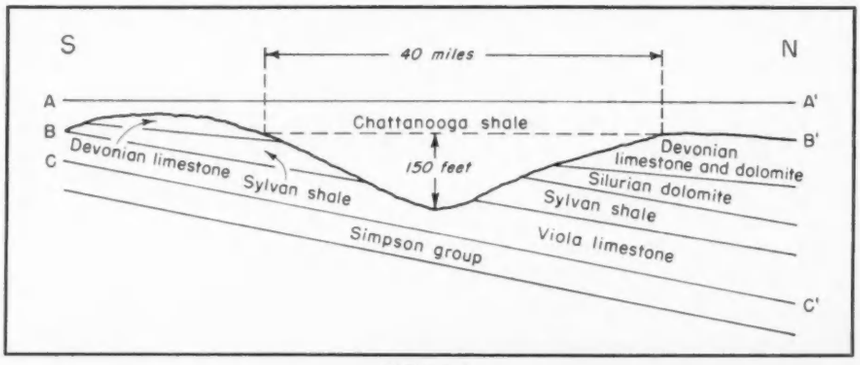


FIGURE 8

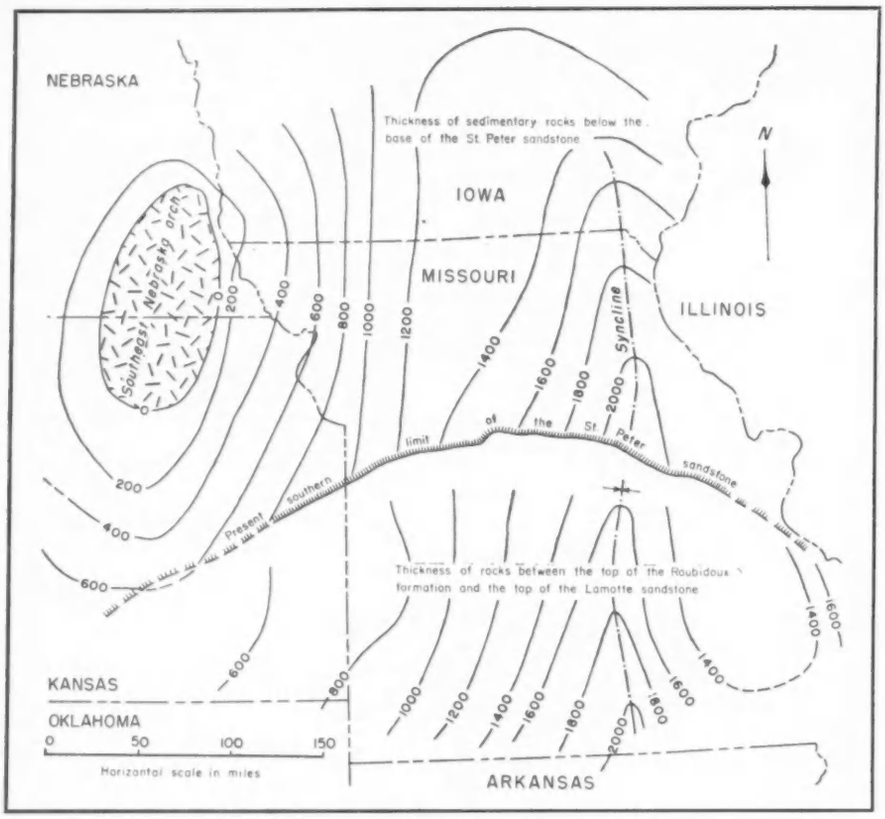


FIGURE 9

Regarded alone, variations of the thickness of rocks between X-X′ and Y-Y′ suggest the occurance of a beveled syncline such as is shown in Figure 7B. However, consideration of the relation of the surface X-X′, to the underlying rocks shows that the thickening of the sequence is accompanied by a compensating thinning in the older rocks as shown in Figure 7C.

A classic example of this relation is shown in Figure 8. The diagram represents a north-south cross section of a valley eroded in the pre-Chattanooga surface of McPherson County, Kansas. The thickening of the Chattanooga shale is compensated by the thinning of the underlying formations.

Examples of application. Figures 9 and 10 illustrate the application of these principles. Both are taken from U.S.G.S. Preliminary Map No. 48 prepared by the U.S.G.S. in co-operation with the Geological Surveys of Kansas, Missouri, Iowa and Nebraska.

Figure 9 shows the thickness in southeastern Kansas does not reveal the Chautauqua arch.

Destruction in this way of regional structural features by later movements is not uncommon, and a number of other phenomena of the kind are known in the Kansas-Missouri area.

The diagrams of Figure 6 are, of course, greatly exaggerated but they illustrate the concept that there may be a shifting of the crest in minor as well as regional anticlines under the influence of later and different patterns of folding. However, where changes in regional dip are low as in most areas in Kansas, shifting of the crest on strong local anticlines seems to be negligible in most cases. There are, however, some exceptions.

Thickness maps alone, however, are not infallible guides in revealing structural movements, and it is necessary to be sure that the limiting surfaces were originally essentially flat. Figure 7A shows the thickness of the rocks between surfaces X-X′ and Y-Y′. Y-Y′ is known to be a reliable datum. X-X′ is an eroded surface which in other areas was a beveled surface with very low erosional relief as indicated by the regularity of the overlying formation.

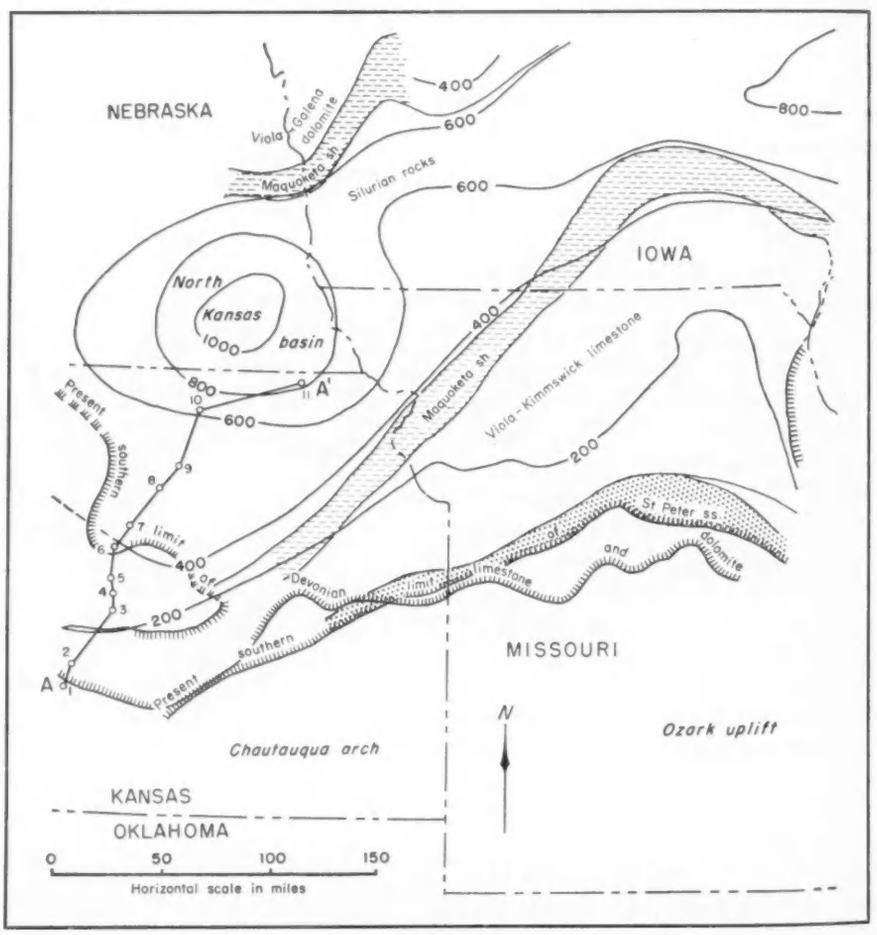


FIGURE 10

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northern Missouri and southern Iowa of all rocks between the Pre-Cambrian and the Simpson group which in this area is represented mainly by the St. Peter sandstone. It includes the Arbuckle group and the Lamotte or Reagan sandstone. The thickness interval is 200 feet. Only those wells which reveal the presence of the Bonneterre at the base of the sequence have been used. Wells in which hills of Pre-Cambrian rocks are overlain by rocks younger than the Bonneterre have been ignored.

Except on such hills, the Bonneterre at the base of the Arbuckle group is widely distributed. It lies near the base of a 2000 foot sequence in northeastern Missouri, which is topped by uppermost Arbuckle and capped by St. Peter. In an area in northeastern Kansas and southeastern Nebraska, the St. Peter overlaps on granite. On the flanks of this area the St. Peter immediately overlies the Bonneterre. Thickness of the sequence thins westward from more than 2000 feet in eastern Missouri to a feather edge in northeastern Kansas on the flanks of the uplifted area, called the Southeast Nebraska arch.

The thickness map reveals that between the deposition of the first sediments on the Pre-Cambrian surface and the deposition of the St. Peter, a deep syncline developed in eastern Missouri accompanied by the rising of the Southeast Nebraska arch. The local broadening of the space between some of the isopachs may represent low secondary structures or, perhaps, minor topographic relief on the Pre-Cambrian surface.

The St. Peter is no longer present in the Ozark region and isopachs to the base of the St. Peter cannot be drawn in southern Missouri. The Roubidoux, however, provides a suitable datum for isopachs.

In southern Missouri thickness lines have been drawn to show the thickness between the top of the lamotte sandstone at the base of the Bonneterre and the top of the Roubidoux. The pattern of folding is similar to that revealed below the St. Peter in northern Missouri.

Near the Arkansas line, the top of the Lamotte had subsided more than 2000 feet below the top of the Roubidoux but only 600 feet on the west limb of the syncline at the margin of control. An anticline seems to have developed in southeastern Missouri.

The thickness map of the Roubidoux-Lamotte sequence in southern Missouri reveals that the syncline recognized in northeastern Missouri was already developing in the same pattern of folding before Roubidoux time and was thus due in part to differential subsidence. Other data indicate that there were intermediate periods of exposure, erosion and beveling during the period of deposition as well as at its close. The pre-St. Peter regional structure is emphasized because Figure 10 shows a complete reversal of the pattern of folding.

Figure 10 shows thickness of rocks between the top of the Arbuckle and the base of the Devonian. The sequence includes the St. Peter sandstone, the Viola or Kimmswick limestone, the Maquoketa or Sylvan shale, and rocks of Silurian age. Thickness can be shown only in areas in which both the Devonian and St. Peter rocks have survived. The several formations of the sequence were truncated by pre-Devonian erosion and cropped out on the pre-Devonian surface in more or less parallel belts flanking the Arbuckle of the Ozark area as shown.

The contour interval is 200 feet. The 50-foot contours of the original map reveal some local irregularities in the thickness due to topographic relief on the upper surface of the sequence but these details do not affect materially the over-all relations shown by 200-foot isopachs.

It will be noted that the area of the Southeast Nebraska arch has become a basin known as the North Kansas basin in which more than 1000 feet of rocks of this sequence underlie the Devonian. The Ozark area, which until St. Peter time was traversed by a deep southerly plunging syncline, has taken the first step toward becoming the Ozark uplift of subsequent geologic history. The southerly plunging syncline in northeastern Missouri has been transformed into a northerly plunging anticline.

Cause of this extraordinary reversal of structural pattern is obscure. It may ultimately be explained by contemporaneous major structural activity in remote regions. Similar reversals in the pattern of deformation occurred during later periods in Kansas and adjoining areas.

Such changes in regional structure although accomplished by slow differential movement must have been accompanied by re-adjustment and migration of ground water and changed the direction of movement of nascent oil. Oil already trapped in an anticline might be in unsymmetrical relation to the anticline after tilting. Where the subsequently imposed regional dip exceeded the closure of an anticline in which oil was already trapped, the oil may have escaped updip.

ACKNOWLEDGMENT

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—The End

About the Author

WALLACE LEE, who retired June 30 after 25 years of combined service with the U. S. Geological Survey and Kansas Geological Survey, specialized in stratigraphic studies in North Central Texas and subsurface geology of Kansas. From 1915 to 1934 Lee was an oil geologist, doing company work, war service, fuel and geological reconnaissance of Siam for the Siamese government, consulting work in Nicaragua, Honduras, Montana, Wyoming, and the Middle West, and private oil operations in Texas and Oklahoma. After graduation from the Colorado School of Mines in 1904, Lee engaged in surveying, prospecting, and mining in Sonora, Mexico. During the Mexican revolution he returned to the U. S. and joined the Missouri Geological Survey in 1910 and the U. S. Geological Survey in 1913, making reports on Missouri, Illinois, Kentucky, and Montana. He is listed in *Who's Who in America*.

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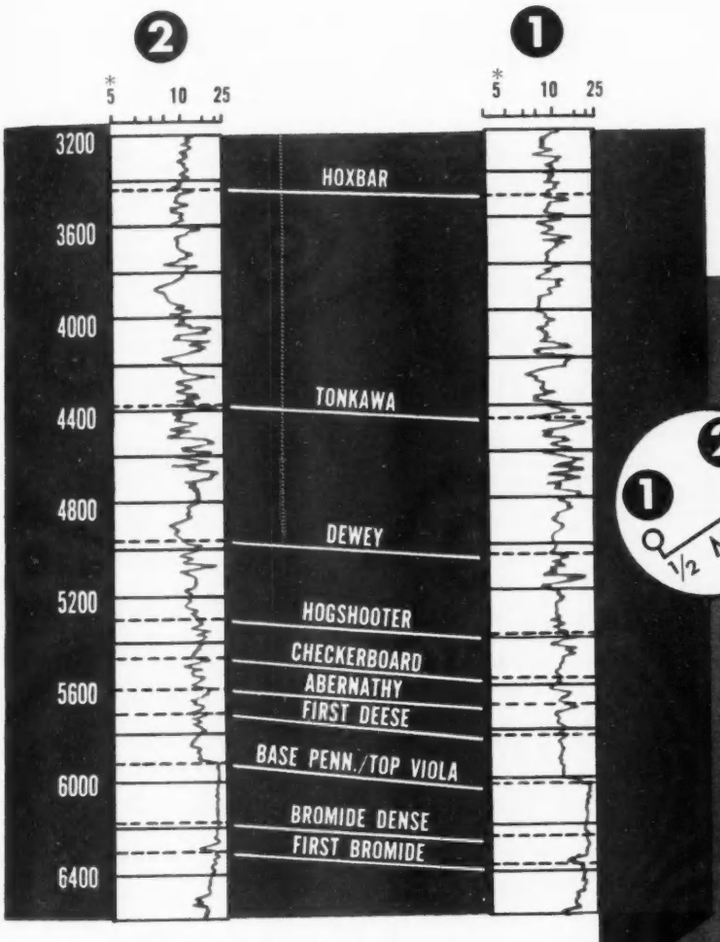

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How to Avoid Costly Errors In Gamma Ray Surveying

• Radiation equipment can be used successfully in the search for oil. But the operator must use suitable instruments, proper surveying methods, and professional interpretation.

• Pitfalls found in past experience must be taken into account.

• Geologist's knowledge of structure, stratigraphy, and porosity is necessary for accurate interpretation of radiation map.

By DR. JOHN W. MERRITT, Consulting Geologist, Tulsa

MUCH SCINTILLATION equipment recently has been developed of high sensitivity for use in uranium exploration. These instruments have displaced the cheaper and less sensitive geiger counter. Now the market offers for immediate delivery new scintillation counters costing from about $100 up to $5000 or more. The availability of this sensitive equipment coming at a time when there has developed a growing interest in gamma ray surveying for oil has induced many oil companies as well as service-minded individuals to go into this new line of work. It is to be feared that these beginners, using a new technique without previous experience or guidance, may be unable to use this new tool correctly and consequently bring this promising method of exploration into disrepute. The reader may recall how this happened to magnetometer surveying some years ago.

Gamma ray surveying has been practiced for about ten years. It was preceded a few years by alpha ray (radon gas) surveys, using gold leaf and similar devices for testing the relative quantity of radon gas in the surface soil. This method, while at times successful, fell into disuse because of the inability of the operators to overcome the sampling procedure variables. After testing radon surveys for several months, engineers who were trying to develop a new "direct method" of oil and gas prospecting turned to the use of gamma ray measurements to accomplish the same purpose.

Geiger counters, which were even then available, were of such low sensitivity that they were of no use. The engineers decided to manufacture a "super-geiger" by building an ionization chamber of many thousand times the capacity for picking up gamma radiation. It took three or four years of trial and error, building and testing, to develop an instrument of suitable sensitivity, stability and portability to handle the low grade radiation usually found in oil country.

During the development, continuous field tests were made for sensitivity and stability. It was not until serious surveying was undertaken, however, that difficulties began to appear in the field which caused false values to creep into the maps, bringing about distortions in the normal pattern. Some of these were detected and eliminated. But it has taken ten years to learn how to make a reasonably usable gamma ray map by which to evaluate an oil or gas prospect. It was not until the end of 1954 that the most serious interference problem was solved.

Instrumentation. Instruments used in this work generally are of two types: (1) The new scintillators which have a probe containing a crystal. Gamma rays cause the crystal to sparkle. A photo-electric device records the degree of illumination in the form of a measurable electric current. (2) Ionization chamber type, in which the old style ionization tube of the geiger counter is enlarged several hundred percent and is charged with a gas at high pressures, giving the instrument several thousand times the capacity of the old style counters to gather and record gamma radiation.

Each of these instruments has its own peculiar advantages and disadvantages. It is important only to mention the requirements necessary in either instrument before it is capable of use in this type of survey. They are:

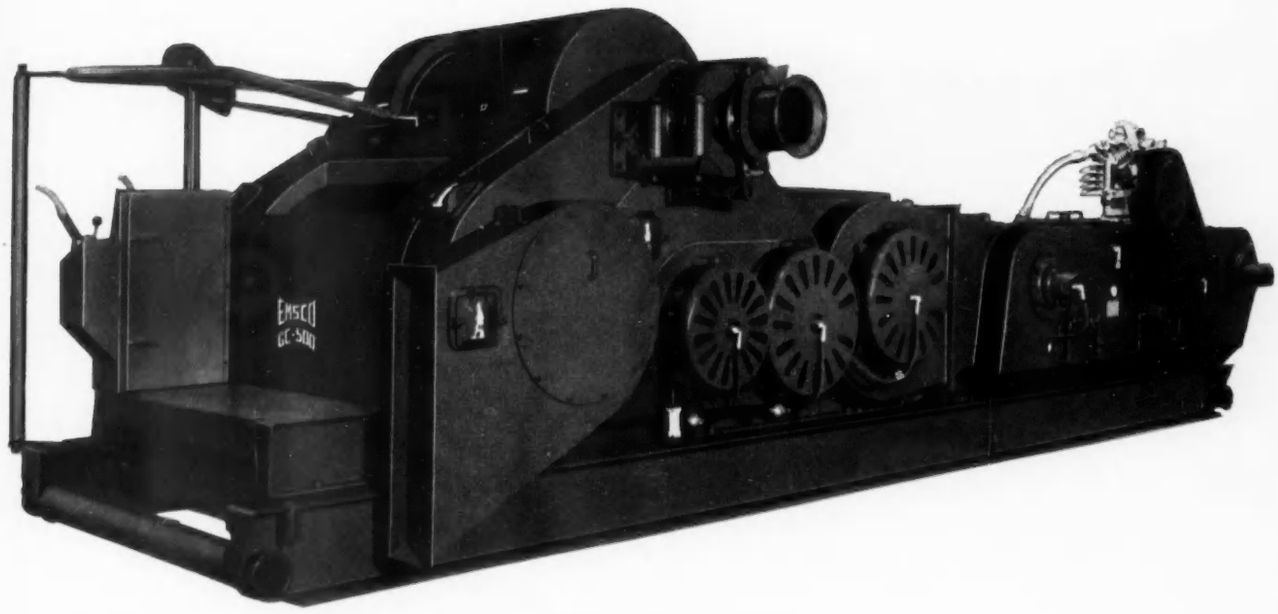
1. They must be sufficiently sensitive to record accurately the low grade radiation found in most weathered soils and to scale the values closely enough to permit the development of a suitable pattern.

2. They must be so constructed as to have the minimum of drift due to temperature and other causes.

3. Because of the irregularity of radiation impulses they must be so constructed as to make it easily possible to integrate the values to a minimum of variation and a maximum of repeatability.

4. They must be light enough to be easily portable in rough terrains and rugged enough to stay in good condition in handling.

Sampling technique. Assuming the use of sensitive, stable and rugged



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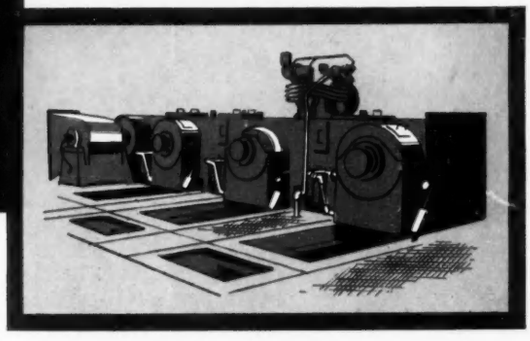

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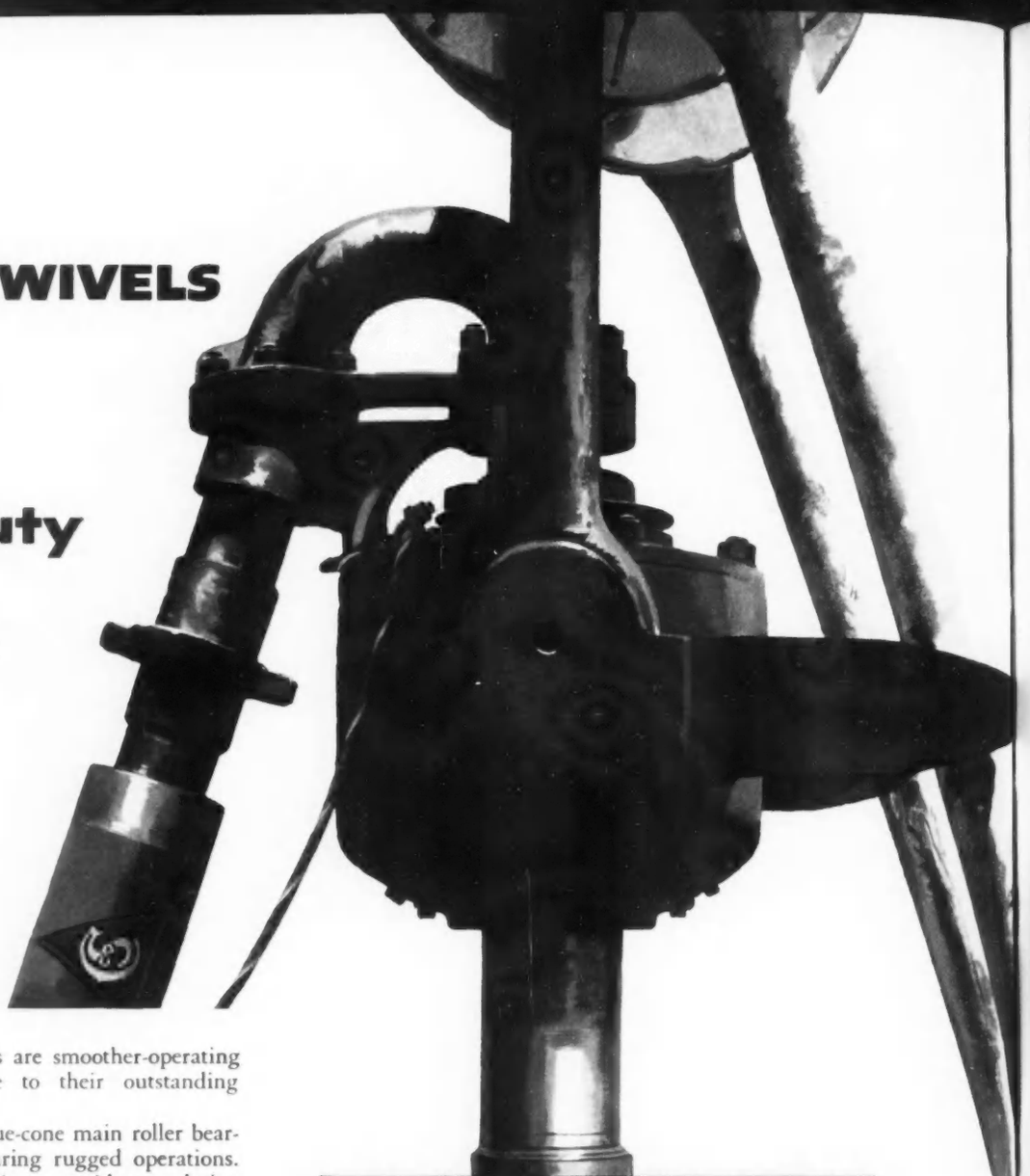

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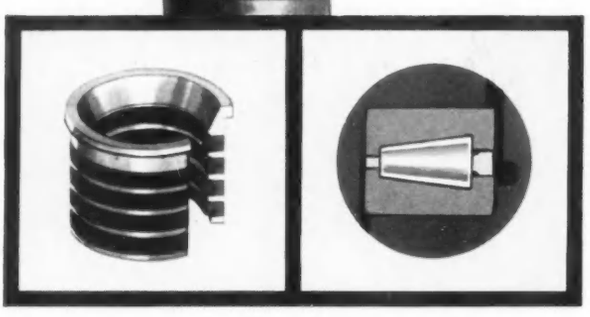

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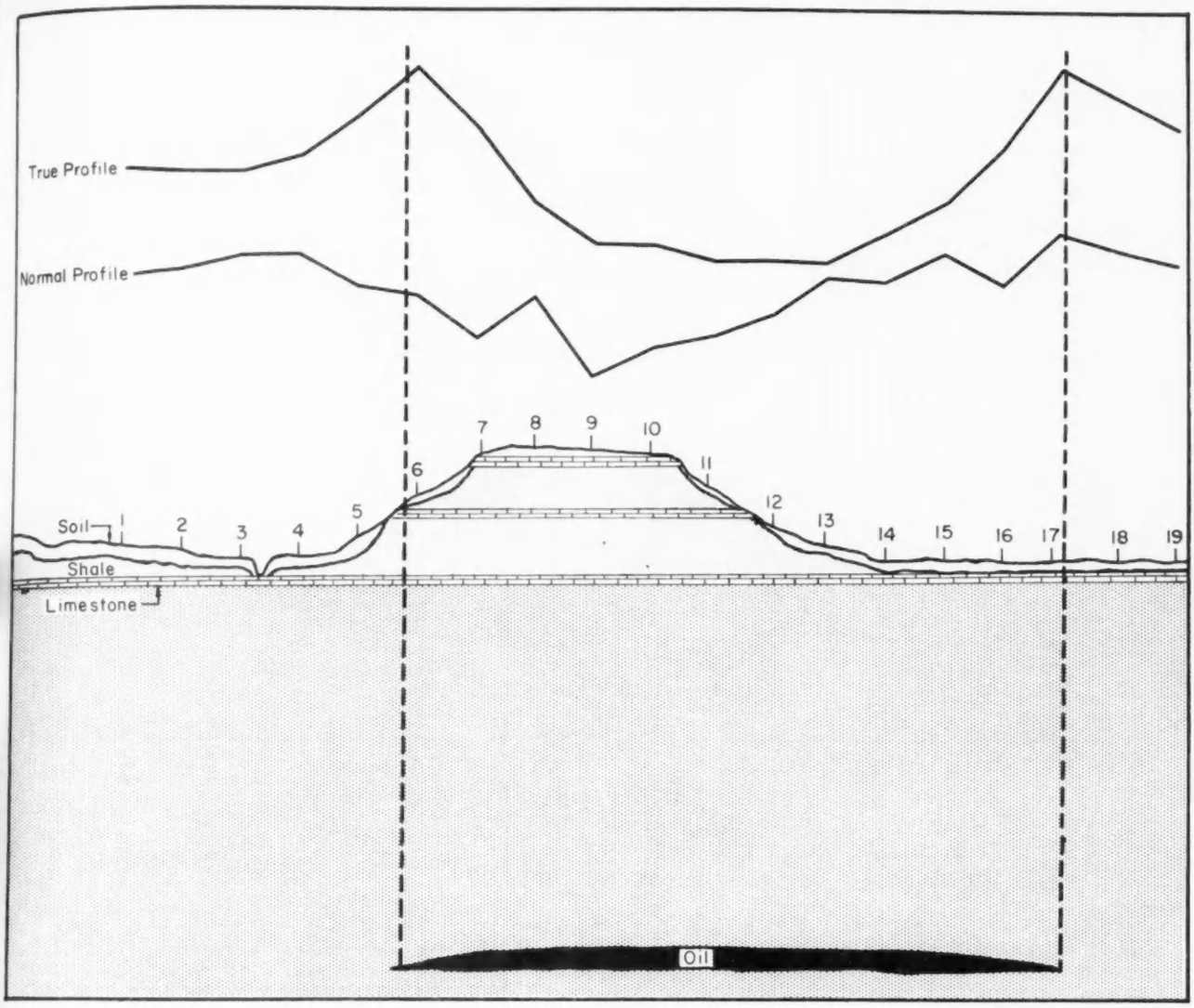


Geological cross-section east and west in surveyed area in Kay County, Oklahoma. Low values in normal profile show lower values as affected by thin soil above limestone caprock. True profile shows effect of soil and bed rock corrections.

instruments suitable for the purpose, no good survey can be made without proper surveying methods. These include:

1. Accurate location of sample stations is necessary. The use of transit or plane-table equipment is too slow and expensive to be practical, especially in rough country. A good compass and chain survey, tied into well established control points, with all circuits closed, will be suitable. A good gamma ray map is no better than the accuracy of its point locations.

2. The sample pattern, both in plan and density, must be so chosen as to cover all possibilities of shape, size and condition of the marginal and other anomalies.

A well trained geologist should be able to do this, adapting the pattern to the local conditions.

3. The area of the survey should be large enough to cover the potential oil or gas pool and reach well into the surrounding background.

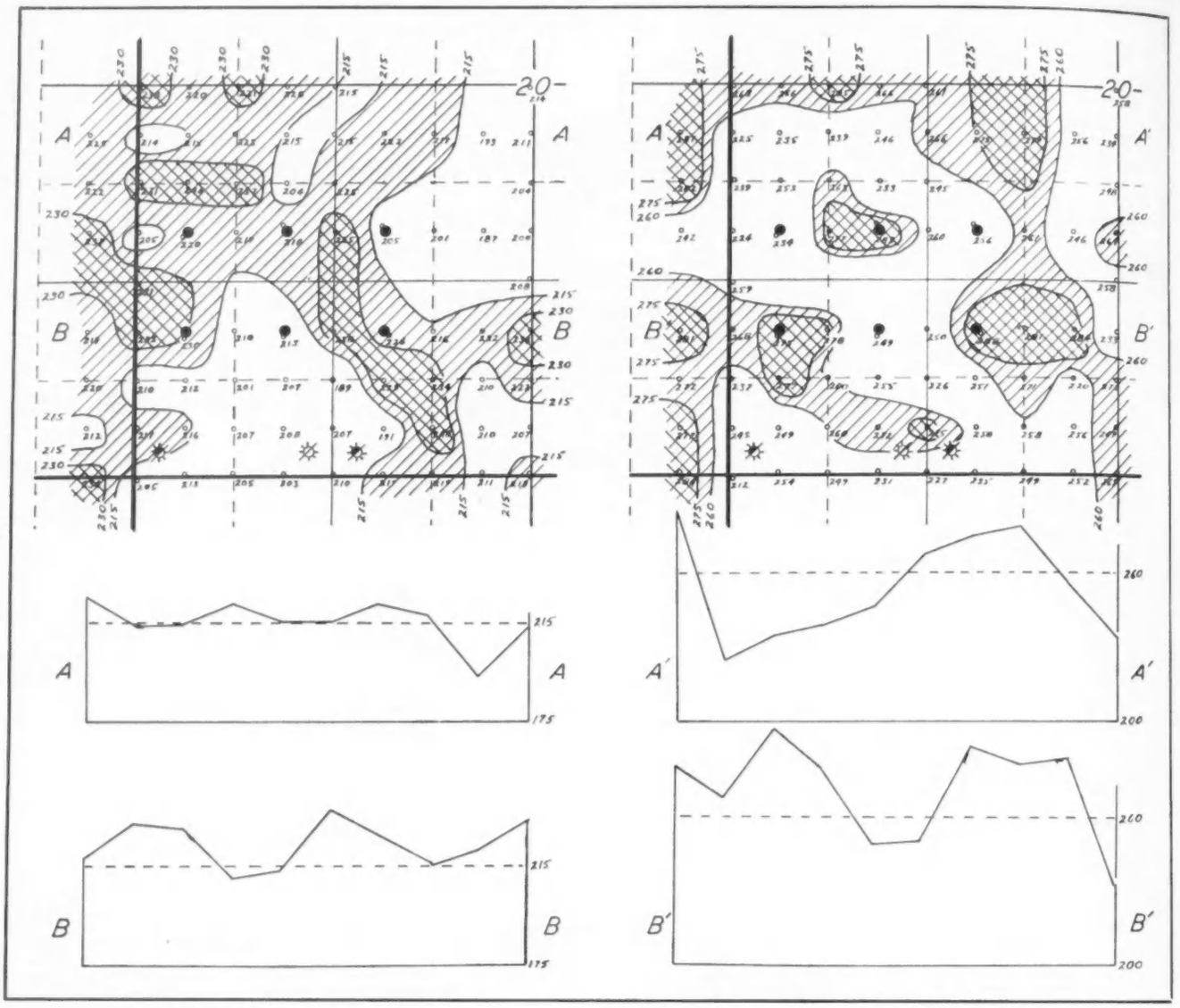
The only exception permitted would be in starting from a known producing area and working outward to the limits of production. In wildcat areas no favorable report should be made where the entire anomalous pattern has not been mapped and completely closed.

Contamination. Five forms of contamination commonly occur to give false values:

1. Radiation coming from a luminous wristwatch, compass or other instrument. These should never be used by operators or be allowed near the equipment while surveying.

2. Fall-out from nuclear explosions sometimes are so radioactive as to keep these sensitive instruments off-scale for days and even weeks until the radiation fades away and resumption of work is possible. These are recognized quickly by watching the daily average readings.

3. Showers frequently bring down



Surface gamma ray map in Creek County, Oklahoma. Map at top left is normal uncorrected map. Map at top right shows effect of correction for soil. Heavy soil area follows valley from southeast to northwest in map at left; causes heavy values. Remainder of map is in light sandy soil. Note changes in contrast after correction as shown in profiles. Abandoned gas wells in south are in sand that pinches out before reaching oil field. Oil wells were completed in Wilcox sand, and gas wells in Bartlesville sand.

scattered radioactive particles in sufficient quantity to materially increase the readings, sometimes into the anomaly range. This effect rarely lasts over 24 hours.

4. Approaching cold fronts sometimes affect the readings. These effects, too, are short-lived.

5. Cuttings, drilling mud, and well brines are usually radioactive. All sample stations should be selected uphill from drilling wells, oil or gas wells, and dry holes wherever possible and should be at least 100 feet away, so as to avoid contamination.

False readings due to natural causes. There are many ways in which the radiation values may be caused to fluctuate due to natural causes. These fluctuations must be either corrected or avoided. Among the most common are:

1. Diurnal variations in cosmic readings. In instruments which do not eliminate cosmic values, account has to be taken of the diurnal cosmic curve. Usually this curve is very flat, and where average or better anomaly contrasts are found, this curve may be ignored. But where the anomaly contrasts are weak, this curve must be figured out by frequent use of check stations.

2. Thin soil above bed-rock yields lower readings than thick soil. It has been found that values from soils less than 12 inches thick above bed-rock must be adjusted to that thickness. Above 12 inches of soil, however, the values do not materially increase.

3. Rock fragments such as are mingled

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with soil in talus slopes also require adjustment in values.

4. Unweathered shales do not react like soil. They are frequently highly radioactive. Readings here should be avoided and such stations omitted or the instrument moved to the nearest available 12-inch soil.

5. Granite wash contains radioactive feldspathic materials, which if mixed with soil, greatly increase radiation values. These points must be avoided.

6. Marshy ground through which water seepage is in motion will be washed free of the critical radiation values that normally would be found here. Such areas must be avoided.

7. Dry lake basins. In certain areas, notably the high plains of the Texas Panhandle, there are broad, shallow depressions without drainage. Into these basins all surface waters flow and bring mineral salts with them to accumulate. Here gamma ray readings are usually exceptionally high. The only remedy is to leave these values out.

8. Soil interference patterns. While the problems mentioned above must be overcome or avoided, they may usually be handled with little difficulty. The one problem which has been found almost insurmountable and which has destroyed so many patterns that it has driven some operators to give up gamma ray surveying is the problem of soil interference patterns.

Almost from the beginning of this method of exploration it was discovered that heavy, argillaceous soil usually yields much higher radiation values than average soil. Conversely, sandy soils read abnormally low. Unfortunately, the nature of the soil often changes back and forth so rapidly as to make general classification impractical. Moreover, the usual soil classification methods lack mathematical scalability.

The basic principle involved is founded upon the fact that heavy argillaceous soils have a greater absorptive value for radioactive solutions than sandy soils, as well as a higher tenacity, so as to retard leaching. Unfortunately these factors conspire to build up false values, which may reach well into the anomaly range. It is thus evident that a true oil anomaly pattern may be destroyed, or conversely, an apparently excellent oil pattern may be falsely constructed.

Experimental work has shown that soil changes of as much as 50 percent or more may occur within a few hundred feet, and change back again as quickly. It also was found that in only a small percent of surveys has the pattern been practically unaltered by soil variables.

To correct for these sudden soil changes, a soil sample must be taken at each sample station, and each sample must be calibrated to permit a correction of the radiation value at that station. Only when all radiation values are adjusted to the basis of uniform soil and the corrected radiation values are mapped, may the map be considered safe to turn over to the interpreter.

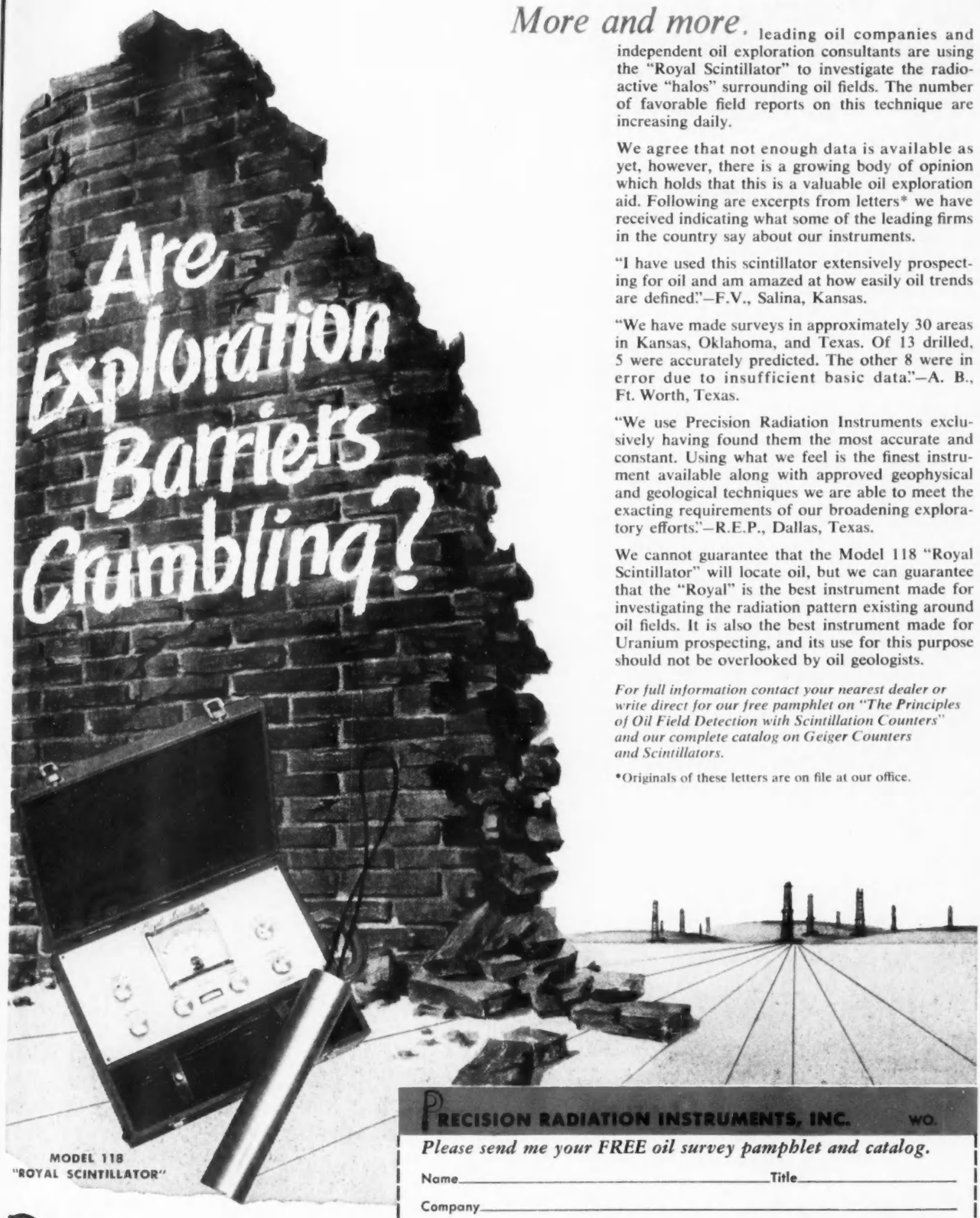
In the process of adjusting radiation values during soil control corrections, it is almost inevitable that some high values may be increased and low values reduced relative to each other. This always results in strengthening the over-all contrasts and thus making the pattern more pronounced. Accordingly, the interpreter has a sharper pattern from which to draw his conclusions.

Interpretation. The principles upon which the interpretation of gamma ray maps is based have been published by the writer and others. The usual favorable pattern is a marginal high anomaly band or series of highs lying approximately above the edges of production and surrounding the favorable area. This is normal for a single producing horizon. Where multiple pay horizons occur, the pattern is the same as though each radiation pattern were superimposed on all the others.

The reader must also always bear in mind that not even a single producing horizon will yield a perfect pattern.

It must become evident to the reader, therefore, that a good knowledge of structure, stratigraphy and porosity conditions, locally and areally, is necessary in the interpretation of even the best radiation map. Unless the map makes geological sense to a well trained and experienced geologist, the area should not be recommended.

—The End



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QUANTITATIVE ELECTRICAL log interpretation is far beyond the academic curiosity stage and can mean hard cash return to many operators provided they will give their geologists and engineers true drilling mud resistivities with which to work. New developments in the analysis of electric logs, toward the end that oil and water saturations and porosities in sands and limes may be calculated very accurately from quantitative interpretation of the resistivity and SP curves, place a responsibility on oil operators that is not well enough known and understood.

It is an unfortunate and costly fact that many electrical logs available today cannot be interpreted quantitatively with any degree of certainty because the data that is absolutely basic to such analysis—the true electrical resistivity of the drilling fluid—has been lost forever.

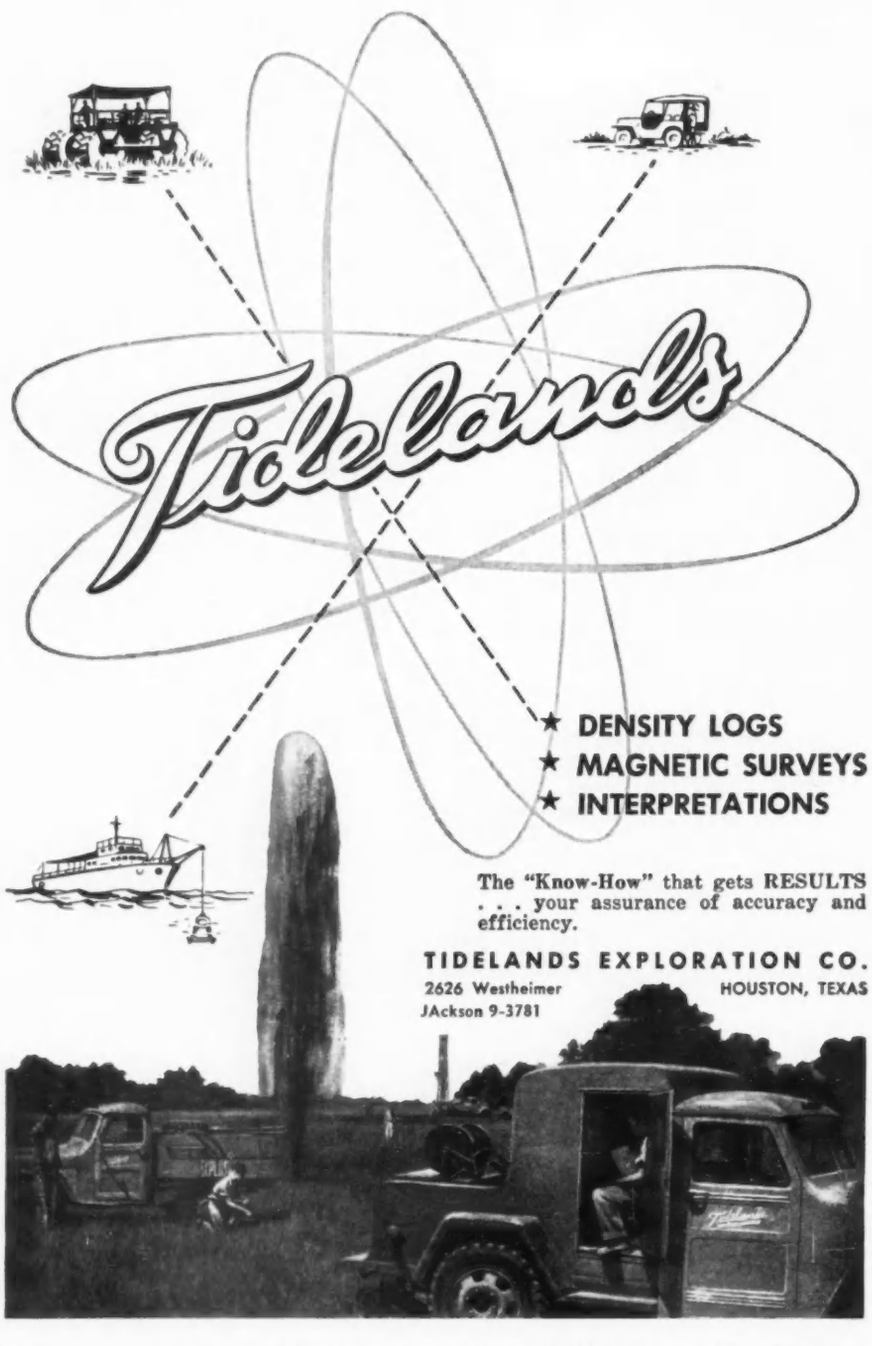
Until recent years almost no one was aware of the importance of acquiring a good drilling mud sample. All too often the sample came from the slush pit at least several hours after the well stopped circulating. Contamination from surface soils, dust, rain, and other substances foreign to the drilling mud in the hole created a situation in which if the true mud resistivity was obtained, it was due to sheer luck; and it is unlikely in such instance that one could be sure that the resistivity data was correct. Any error in the mud resistivity value is multiplied many times in the eventual porosity and saturation determinations.

An operator stands to help himself and to help the industry if he will adopt a standard procedure requiring the drilling crew to collect mud samples, preferably two (clean) buckets full, after logging depth has been reached, just before the well stops circulating. The best place to draw samples is from the mud flow line if there is one, or as close to the wellhead as possible if there is no flow line. In the latter case, the danger from contamination is greater, particularly from water falling from the derrick floor while it is being washed down. Obviously, it is just as easy to collect mud samples the right way as the wrong way. And there is no reason why drilling crews cannot be as diligent about sampling mud for logging purposes as they must be in making periodic checks on mud weight, viscosity, and water loss.

Whenever possible, operators should avoid any drastic changes in the mud program when an electric log is about to be run.

The electrical logging firms bear the responsibility of noting on the logs the source of the mud sample on each run, so that logs that are suitable to accurate interpretation may readily be discerned from those that are not.

Good operating practice behooves the operator to provide himself and the industry with correct mud resistivity data. —**The End**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• WILDCAT DRILLING—IN JUNE AND FIRST SIX MONTHS, 1955-1954

STATE or DISTRICT	MONTH OF JUNE, 1955						FIRST SIX MONTHS, 1955-1954								
	New Fields			Total Discoveries	Dry Wildcats	Total Wildcat Tests	New Fields			Total Discoveries		Dry Wildcats		Total Wildcat Tests	
	Oil	Distillate	Gas				Oil	Distillate	Gas	6 Mo. 1955	6 Mo. 1954	6 Mo. 1955	6 Mo. 1954	6 Mo. 1955	6 Mo. 1954
Alabama	..	..	..	..	1	1	..	..	..	..	..	28	36	28	36
Arizona	..	..	..	..	..	..	..	..	..	..	..	4	8	4	8
Arkansas	..	..	1	1	8	9	5	..	2	7	3	62	41	69	44
California	1	..	2	3	16	19	10	..	2	12	13	144	167	156	180
Colorado	3	..	3	6	64	70	22	1	15	38	36	356	220	394	256
Florida	..	..	..	..	3	3	..	..	..	..	1	16	13	16	14
Georgia	..	..	..	..	..	..	..	..	..	..	..	....	3	....	3
Idaho	..	..	..	..	..	..	..	..	..	..	..	2	....	2	....
Illinois	3	..	..	3	54	57	6	..	1	7	16	291	267	298	283
Indiana	1	..	1	2	12	14	8	..	1	9	9	66	113	75	122
Kansas	20	..	5	25	77	102	79	..	21	100	58	436	372	536	430
Kentucky	3	..	..	3	18	21	10	..	1	11	18	53	23	64	41
Louisiana	7	2	..	9	37	46	19	12	..	31	38	211	174	242	212
North Louisiana	2	1	..	3	14	17	3	1	..	4	3	77	59	81	62
South Louisiana	5	1	..	6	23	29	16	11	..	27	35	134	115	161	150
Michigan	..	..	..	..	19	19	2	..	..	2	7	98	116	100	123
Mississippi	3	1	..	4	14	18	5	1	..	6	1	88	76	94	77
Missouri	..	..	..	..	4	4	..	..	..	..	..	17	6	17	6
Montana	3	..	..	3	8	11	4	..	..	4	4	41	41	45	45
Nebraska	4	..	..	4	39	43	19	..	..	19	15	144	55	163	70
Nevada	..	..	..	..	..	..	..	..	..	..	1	4	7	4	8
New Mexico	3	..	6	9	17	26	12	1	12	25	26	75	88	100	114
North Dakota	1	..	..	1	5	6	1	..	..	1	1	21	49	22	50
Ohio	..	..	..	..	1	1	..	..	1	1	..	13	7	14	7
Oklahoma	15	1	2	18	57	75	48	5	10	63	72	291	336	354	408
Oregon	..	..	..	..	1	1	..	..	..	..	..	1	....	1	....
Pennsylvania	..	..	..	..	2	2	..	..	..	..	..	2	....	2	....
South Dakota	..	..	..	..	2	2	..	..	..	..	1	6	8	6	9
Texas	55	11	5	71	367	438	267	41	33	341	353	2,013	2,022	2,354	2,375
Dist. 1: South Central	2	1	..	3	35	38	11	4	1	16	22	206	125	222	147
Dist. 2: Middle Gulf	2	4	1	7	21	28	8	9	5	22	17	116	130	138	147
Dist. 3: Upper Gulf	2	2	1	5	35	40	9	10	6	25	20	200	194	225	214
Dist. 4: Lower Gulf-S.W.	3	1	1	5	43	48	13	9	4	26	30	213	187	239	217
Dist. 5: East Central	..	..	..	..	8	8	3	2	..	5	..	65	70	70	70
Dist. 6: Northeast	..	2	..	2	21	23	3	3	..	6	4	88	79	94	83
Dist. 7-B: North Central	20	..	..	20	75	95	79	..	7	86	91	412	409	498	500
Dist. 7-C: West Central	6	..	..	6	29	35	19	..	4	23	33	139	177	162	210
Dist. 8: West	7	..	..	7	41	48	45	..	1	46	60	237	208	283	268
Dist. 9: North	13	..	2	15	57	72	75	..	4	79	67	315	411	394	478
Dist. 10: Panhandle	..	1	..	1	2	3	2	4	1	7	9	22	32	29	41
Utah	3	..	1	4	5	9	5	..	2	7	3	30	14	37	17
West Virginia	..	..	1	1	..	1	..	..	7	7	..	10	....	17	....
Wyoming	2	..	1	3	13	16	12	..	2	14	47	79	101	93	148
Total United States	127	15	28	170	844	1,014	534	61	110	705	723	4,602	4,363	5,307	5,086

Mid-Year Wildcats at Peak

June's record boosts year's lead to 4 percent.

By CECIL W. SMITH, World Oil Staff

June was the busiest month of the year for U. S. wildcatters and only once before in the industry's history has activity been so bustling. The month's large number of completed tests boosted the year's aggregate to an even larger lead over last year than had been held and made 1955 an easy front-runner in the wildcat volume race.

A total of 1014 wildcat tests was completed during June. That was a substantial hike from the 923 recorded in both the preceding month and June of last year. It was also the third time in history that as many as 1000 wildcats had been completed in a single month. The first time it occurred was in July, 1954, and next in December of the same year. However, June's total was shaded only by December's, which probably contained some tests that had been drilled previously, but not officially completed until just time to get them into the fiscal year. If that assumption is true, then June's completed tests topped all others in volume.

During the first six months of 1955, a grand total of 5307 wildcats was completed, giving the year at half-time a lead of 4.3 percent over the 5086 drilled in the comparable period of 1954, the year that holds the record for drilling. June's operations boosted the year's margin over 1954 to 4.3 percent from the 3.1 percent lead that was held at the end of May.

Summary of Results of Wildcat Drilling

ITEM	June 1955	May 1955	SIX MONTHS January-June 1955	1954	Percent Diff.
New Field Discoveries:					
Oil	127	75	534	549	— 2.7
Distillate	15	8	61	62	— 1.6
Gas	28	19	110	112	— 1.8
Total Discoveries	170	102	705	723	— 2.5
Dry Wildcats	844	821	4602	4363	+ 5.5
Total Wildcat Tests	1014	923	5307	5086	+ 4.3
Percent Productive	16.8	11.1	13.3	14.2	....
Percent Dry	83.2	88.9	86.7	85.8	....

Numerically, current year is ahead in total wildcatting, but not in the number of tests that made commercial producers. Actually, the 1955 search is trailing last year by 2.5 percent in the number of discoveries made. So far, 705 discoveries of various types have been uncovered, and they amounted to a pretty fair 13.3 percent of the total drilled. However, last year at the same time, discoveries had numbered 723, and that slightly higher total resulting from fewer tries amounted to a somewhat better 14.2 percent batting average.

Wildcatter's efforts in the first six months were rewarded with 534 new oil discoveries. That failed by 15 new oil fields or 2.7 percent of matching the 1954 record. Gas and gas-distillate finds were closer; being 110 gas discoveries to 112 last year, and 61 new gas-distillate fields opened to 1954's 62.

Density of Drilling Muds Reduced by Air Injection

Here are the charts for estimating air volumes required to give desired reductions, together with the derivation of the necessary equations.

By F. H. POETTMANN and W. E. BERGMAN,
Research and Development Department, Phillips Petroleum Company, Bartlesville, Okla.

LOSS OF CIRCULATION is a troublesome and costly difficulty encountered in drilling. With liquid muds the most universally applied remedial practice involves reduction of the mud density and addition of a sealing agent to the mud. With water or oil as the circulating fluid the minimum fluid density is in the range of 7 to 8.3 pounds per gallon giving pressure gradients of 0.37 to 0.43 pounds per square inch per foot of depth. Even lower pressure gradients can be achieved by drilling with air or gas. Drilling with air and gas has become increasingly popular and results in increase in penetration rate and bit life. A low density system may also be produced by injection of air or gas into conventional mud. The effective mud density at the bit is then a function of the relative volume of the mud to the gas. Air injection has several important advantages over gas drilling:

- Fire and dust hazards are eliminated.
- It is applicable to any type of formation—hard or soft, dry or wet whereas air drilling requires a dry condition.
- When required, the mud density can be rapidly increased to stop salt water flow or a blow out.
- The hole may be eventually conditioned to withstand a higher density mud thereby permitting full-depth logging and improving success for primary cementing of casing.

Air injection has apparently been practiced prior to 1941.[2] Interest was renewed by Phillips Petroleum Company and the procedure was applied in the Huntington No. 1, Emery County, Utah.[1] In connection with this early test, a chart was prepared relating the volume of air per barrel of mud to the effective reduction of mud density at depths to 10,000 feet.[1] Subsequently, additional tests have been conducted and additional charts were prepared to extend the range of applicability and accuracy. In view of current interest on this subject, these charts are herein presented, together with the derivation of the necessary equations.

Derivation of equations . . .

A. Static Mud Column

Assuming that it were possible to keep the air completely dispersed in a static column of mud, an equation can be derived for calculating the amount of air necessary to give a desired mud weight.

Starting with the general flow equation:

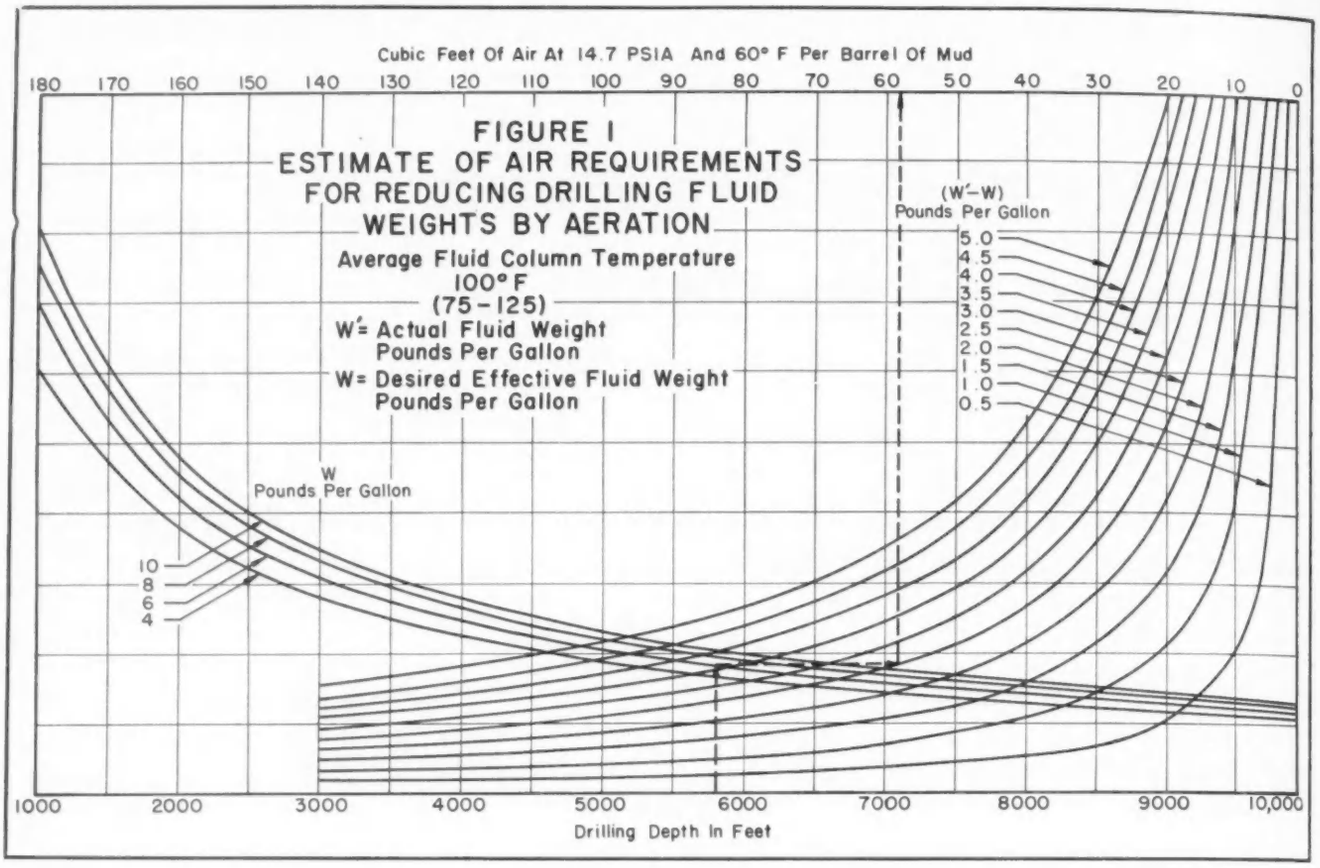
$$\int_{P_2}^{P_1} VdP + \Delta h + \frac{\Delta v^2}{2g_c} + W_f + W_s = 0 \qquad (1)$$

Where:

V = specific volume of flowing fluid in cubic feet per pound
P = pressure in pounds per square foot absolute
$\Delta h = h_2 - h_1$ = difference in elevation above datum plane, feet
$\frac{\Delta v^2}{2g_c}$ = kinetic energy change of one pound of flowing fluid
W_s = work done by the fluid while in flow
W_f = energy losses due to the irreversibilities of the fluid in flow.

In the case of a static column of fluid, Equation 1 reduces to:

$$\int_{P_2}^{P_1} VdP + \Delta h = 0 \qquad (2)$$



Defining V_m as the cubic feet of mixed air and mud at pressure P per barrel of mud and M as the weight of air and mud per barrel of mud, Equation 2 can be written on rearrangement as follows:

$$\Delta h = \frac{1}{M}\int_{P_2}^{P_1} V_m dP \qquad (3)$$

Where:

$$V_m = 5.61 + \frac{2117\ Tavg\ S}{520\ P} \qquad (4)$$

$$M = (5.61)\ (62.4)\ (G') + (.0764)S \qquad (5)$$

Tavg = average mud temperature °R
S = standard cubic feet of air (14.7 psia and 60 F) per barrel of mud
G' = specific gravity of mud

By substituting Equation 4 in Equation 3:

$$\Delta h = \frac{1}{M}\int_{P_2}^{P_1} 5.61\ dP + \frac{1}{M}\int_{P_2}^{P_1} \frac{2117\ Tavg\ SdP}{520\ P} \qquad (6)$$

Integrating Equation 6

$$\Delta h = \frac{5.61}{M}\ (P_1 - P_2) + \frac{2117\ Tavg\ S}{520\ M}\ \ln\ \frac{P_1}{P_2} \qquad (7)$$

Substituting Equation 5 in Equation 7 and simpifying results in:

$$\Delta h = \frac{5.61\ (P_1 - P_2) + 4.071\ Tavg\ S\ \ln\ \frac{P_1}{P_2}}{350.06\ G' + 0.0764\ S} \qquad (8)$$

The pressure P_2 on the annulus side at the top of the hole can usually be taken as 2117 pounds per square foot (14.7 psia). The pressure P_1 at the bottom of the hole in terms of the desired mud specific gravity on aeration (G) can be calculated from the following equation:

$$P_1 = P_2 + \Delta h\ (62.4)\ (G) \qquad (9)$$

B. Vertical Flow Upward In The Annulus

For vertical flow upward Equation 1 can be reduced to

$$\int_{P_1}^{P_2} VdP + \Delta h + W_f = 0 \qquad (10)$$

since $\frac{\Delta v^2}{2yc}$ can be neglected and W_s is equal to zero.

The energy loss W_f can be correlated by the well known Fanning equation.

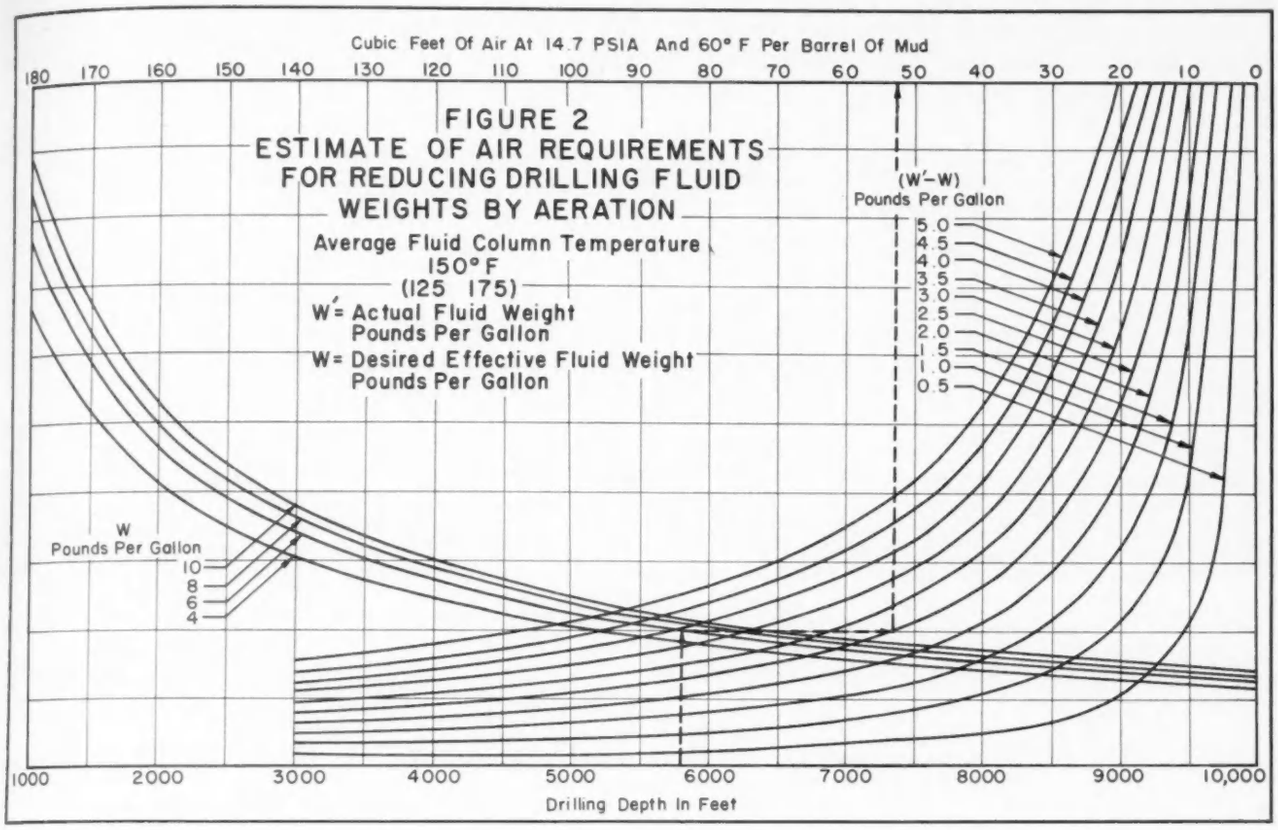
$$W_f = \frac{4f\bar{v}^2\Delta h}{2g_c D} = \frac{fQ^2\overline{V}_m^2}{7.413 \times 10^{10} D^5} \qquad (11)$$

Where:

Q = barrels of mud flowing per day
$\overline{V}_m$ = integrated average value of V_m between the pressure limits of P_1 and P_2.
D = equivalent diameter of flow string in feet.

By introduction of V_m and M, substitution of Equations 4, 5, and 11 in Equation 10 and rearranging, one obtains:

$$\Delta h = \frac{\frac{1}{M}\int_{P_2}^{P_1} 5.61\ dP + \frac{1}{M}\int_{P_2}^{P_1} \frac{2117\ Tavg\ S}{520}\ \frac{dp}{P}}{1 + \frac{fQ^2V_m^2}{7.413 \times 10^{10} D^5}} \qquad (12)$$


Cubic Feet Of Air At 14.7 PSIA And 60° F Per Barrel Of Mud
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
FIGURE 2
ESTIMATE OF AIR REQUIREMENTS FOR REDUCING DRILLING FLUID WEIGHTS BY AERATION
Average Fluid Column Temperature 150° F (125 175)
W' = Actual Fluid Weight Pounds Per Gallon
W = Desired Effective Fluid Weight Pounds Per Gallon
(W'-W) Pounds Per Gallon
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
W Pounds Per Gallon
10
8
6
4
1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000
Drilling Depth In Feet

Integrating:

$$\Delta h = \frac{5.61(P_1 - P_2) + 4.071\ T_{avg}\ S \ln \frac{P_1}{P_2}}{(350.06\ G' + 0.0764\ S)\left(1 + \frac{fQ^2 \overline{V}_m^2}{7.413 \times 10^{10} D^5}\right)} \quad (13)$$

For annular flow:

$$D^5 = (D_1 + D_2)^2 (D_1 - D_2)^3. \quad (14)$$

$\overline{V}_m$ can be calculated from:

$$\overline{V}_m = \frac{\int_{P_2}^{P_1} V_m dP}{P_1 - P_2} = \frac{\int_{P_2}^{P_1} 5.61\ dp + \int_{P_2}^{P_1} 4.071\ T_{avg}\ S \frac{dp}{P}}{P_1 - P_2}$$

$$\overline{V}_m = 5.61 + \frac{4.071\ T_{avg}\ S}{P_1 - P_2} \ln \frac{P_1}{P_2} \quad (15)$$

Example Calculations

Example 1.

Calculate the amount of air to be injected into a mud to give a desired mud weight of 8 pounds per gallon. The actual mud weight is 8.60 pounds per gallon. The drilling depth is 6000 feet. The average mud column temperature is 100 F. Assume a static mud column and P_2 to be 14.7 psia.

P_1 is calculated from Equation 9:

$$P_1 = (14.7)\ (144) + 6000\ (62.4)\frac{(8)}{(8.33)}$$

$$P_1 = 2117 + 359{,}568$$

$P_1 = 361{,}685$ pounds per square foot.

Substitution in Equation 8:

$$6000 = \frac{(5.61)\ (359{,}568) + (4.071)\ (560)\ S \ln \frac{361.685}{2117}}{(350.06)\ \frac{8.6}{8.33} + 0.0764\ S}$$

$$6000 = \frac{2{,}017{,}176 + 11{,}721\ S}{361.4 + 0.0764\ S}$$

$$2{,}168{,}400 + 458\ S = 2{,}017{,}176 + 11{,}721\ S$$

$$S = \frac{151{,}224}{11{,}263} = 13.43 \text{ cubic feet air per barrel of mud.}$$

(60° F, 14.7 psia)

Estimated brake horsepower required to compress air against 500 psia is 40 HP.

Example 2.

Repeat Example 1 for a flow of 500 barrels of mud per hour through an annulus the casing side of which has an inside diameter of 8.150 inches (0.6792 feet) and the drill stem side having an OD of 4.5 inches (0.375 feet). Using Equation 14:

$$D^5 = (1.0542)^2\ (0.3042)^3 = 0.03128$$

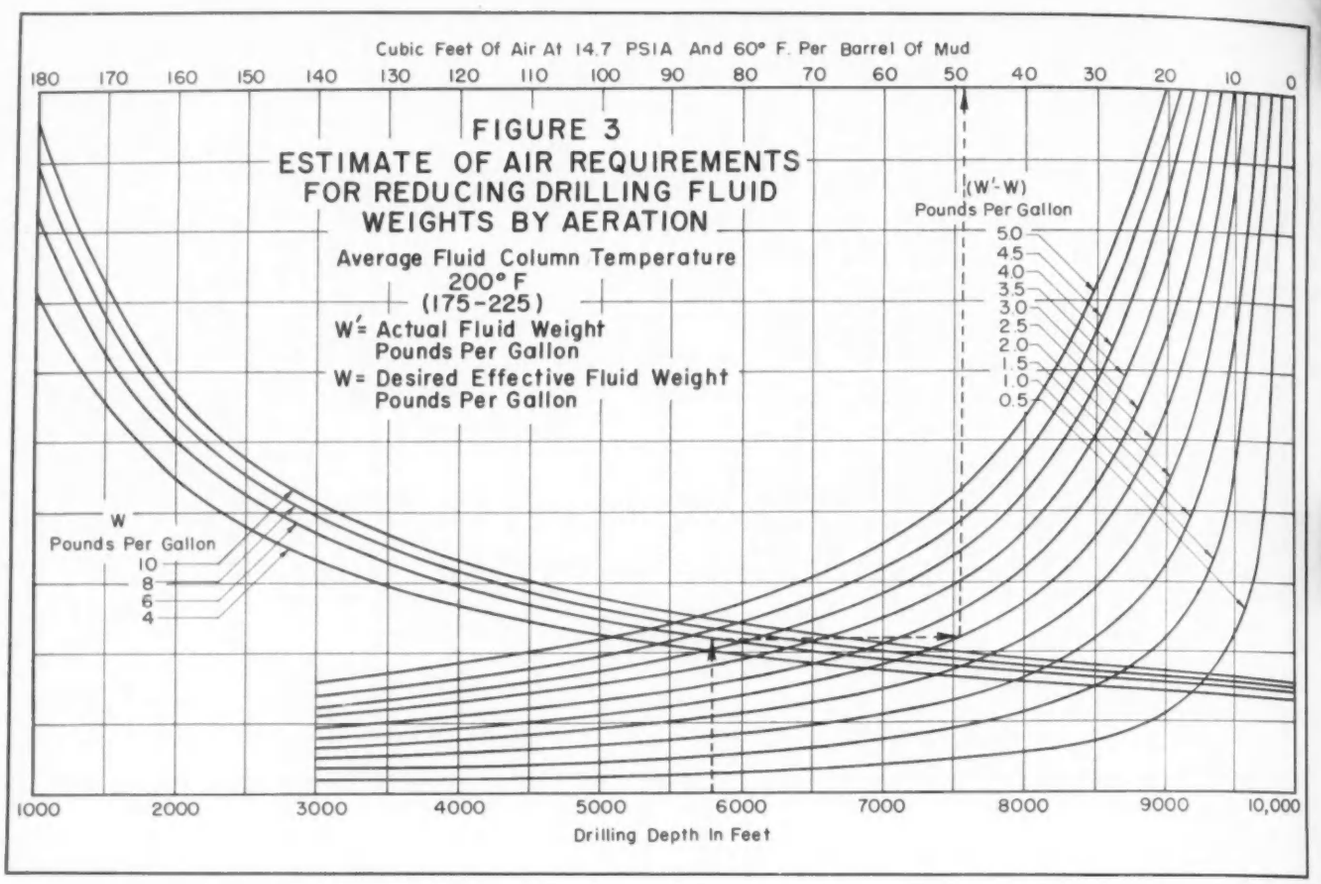
and $Q = (500)\ (24) = 12{,}000$ barrels per day

The coefficient f necessary to apply Equation 13 was estimated from Figure 4 of reference (2). The abscissa of this figure is equal to

$$\frac{1.4737 \times 10^{-5}\ MQ}{D} = \frac{(1.4737 \times 10^{-5})\ (12 \times 10^3)\ (361.4 + 0.0764\ S)}{1.0542} = 60.6$$

where $D = (D_1 + D_2)$. The coefficient f is found to be 0.0034.

The part of the function containing S can be dropped



since the order of magnitude of the value containing S is less than one.

From the previous example P_1 = 361,685 pounds per square foot.

Various values of S are then assumed and the $\triangle h$ corresponding to those values calculated. The value of S corresponding to a depth of 6000 feet is then the correct solution.

Assumed Value of S	$\triangle h$ Equation 13
14.0	5971
14.5	5987
14.94	6000
15	6001.7

By plotting the values of S versus $\triangle h$ calculated, the value of S at a depth of 6000 feet is 14.94 cubic feet of air per barrel of mud.

Estimated brake horsepower required to compress air against 500 psia is 44 HP.

These calculations for static and flowing conditions illustrate application of the equations. The values obtained for the volume of air required, assuming a static and flowing column of air-mud mixture, are 13.43 and 14.94 cubic feet, respectively. The difference is sufficiently small to justify general application of the more simple, static equations for this particular application.

Graphic estimation of air requirements . . .

To facilitate practical application of these equations charts were prepared as shown in Figures 1, 2 and 3. These charts may be used to estimate the volume of air which may be injected into any mud to obtain the desired effective fluid density at depths from 1000 to 10,000 feet. For these charts average fluid column temperatures of 100°, 150° and 200° F. were used. The effect of temperature, as will be illustrated, is not large. Hence, each chart may be safely used to cover a range of 50° F. For most wells having a depth to 10,000 the bottom hole circulating temperature will not exceed 150° F. and the discharge temperature will be 10° to 25° F. lower than the bottom hole circulating temperature. Figures 1 and 2 will therefore be most generally applicable.

The dotted lines on the charts illustrate the method of use. For example, at a drilling depth of 5800 feet with an average column temperature of 100° F., it is desired to obtain an effective density of 6 pounds/gallons with mud having a density of 8.5 pounds/gallons. From Figure 1, the air requirement is found to be 58 cubic feet (measured at 14.7 psi and 60° F.) per barrel of mud. This same problem for average temperatures of 150° and 200° F. gives values of 53 and 49 cubic feet per barrel and illustrates the rather small effect of temperature.

REFERENCES

[1] Bobo, R. A. and Barrett, H. M., "Aeration of Drilling Fluids," WORLD OIL, 137, No. 4, 145 (1953).

[2] Drilling Equipment Directory; Edition of 1941-42, page K-20, Directory Publishing Company, Tulsa.

[3] Poettmann, F. H., and Carpenter, P. G., Drilling and Production Practice, 257 (1952).

—The End

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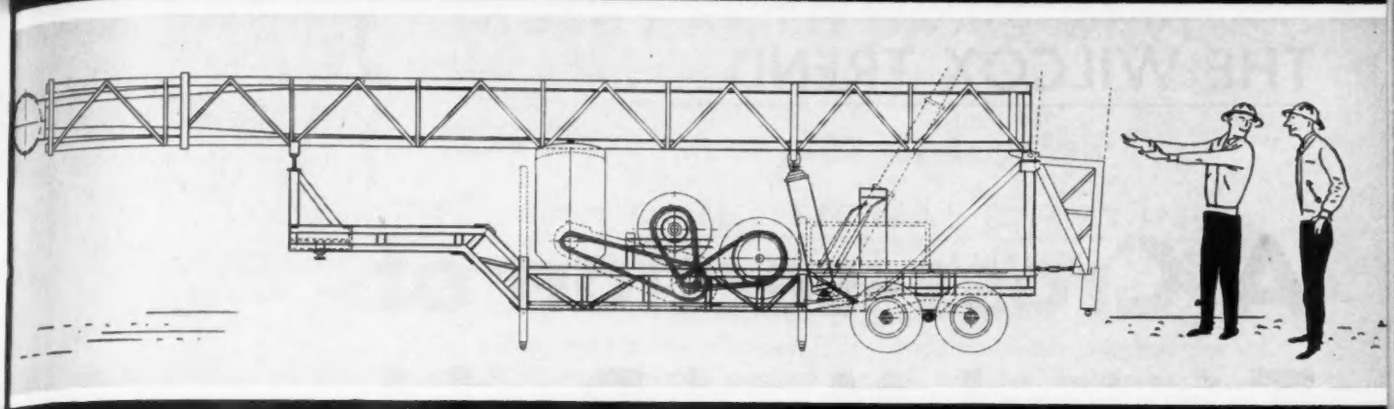
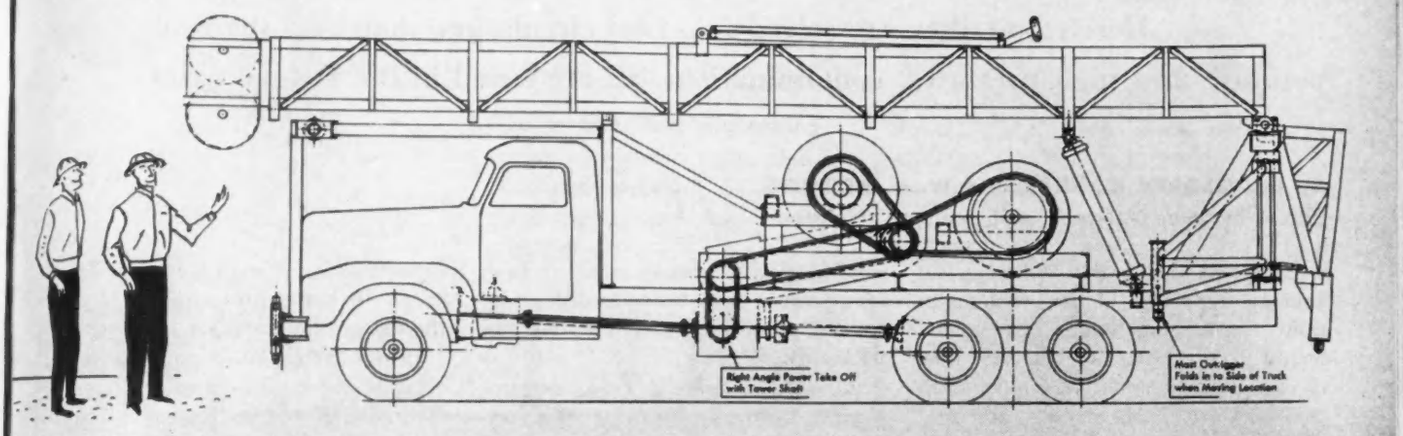


WILSON MANUFACTURES BOTH



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THE WILCOX TREND . . .

A Cross-section of Typical Mud Problems

Here's how they are solved . . . Lost circulation, sloughing shale, high temperature and high pressures, contamination—all are found in the Wilcox trend.

By DR. GEORGE R. GRAY and W. C. KELLOGG,
Baroid Division, National Lead Company, Houston

DRILLING ALONG the Wilcox trend presents almost all of the problems in mud engineering which are to be found in any region of like size. Loss of circulation, sloughing shale, high pressures and high temperatures and contamination of the mud by anhydrite and salt are not common throughout the area but one or more of these problems may be found in almost any limited locality along the Wilcox trend, and all might cause trouble in a single deep well in south Texas.

Muds weighing over 12 pounds per gallon are seldom needed above 10,000 feet in the upper Gulf Coast, or above 8000 feet in southwest Texas, and mud practices to these depths are fairly uniform. In some cases, resistivity of the mud is reduced to improve the electrical log. Oil emulsion muds are in common use to speed up rate of penetration. Mud costs range from $5000 to $10,000.

For deeper drilling, costs increase proportionately as drilling problems multiply. Mud weights in excess of 17 pounds per gallon are required to control pressures. Temperatures above 350° F. have been recorded. Particular attention then must be given to the mud treatment. Trouble from solidification of heavy mud at high temperature has been avoided by careful control of solid content and alkalinity.

Almost 300 fields in Texas are producing from the Eocene Wilcox. These fields are scattered through 32 counties, and lie in a band roughly 50 miles wide, 60 to 80 miles inland from the Gulf of Mexico, and stretching from the Sabine River to the Rio Grande. Production may be found from as shallow as 500 feet to yet-to-be-determined depths below 15,000 feet.

GENERAL MUD PRACTICES

Surface hole. Starting mud is prepared from bentonite, and sometimes other drilling clays, with lime added to produce a thick gel. Water of satisfactory quality for mixing mud is obtained from wells 50 to 600 feet deep. Mud may be hauled by vacuum truck from reserve pits of completed wells. Mud may be lost into the beds of gravel and sand, and sometimes fibrous and granular materials are added to the thick, gelled mud. The depth at which surface casing is set depends on the depth of the fresh water sands and ranges from about 1000 to 3000 feet. A trip is made with a rock bit to assure a clean hole before 10¾-inch (sometimes 9⅝-inch) casing is run. From 36 to 48 hours are required to drill the surface hole and set casing.

Little attention is paid to properties of the mud used in drilling surface hole, except to make certain it is thick enough to clean the gravel sections of the hole. The high gel strength holds sand in suspension and the mud weight reaches 9.5 to 10 pounds per gallon. Funnel viscosity is about 100 seconds, and water loss is 15 to 30 cc API. Mud materials for surface hole cost between $50 and $200. After casing has been set, sand and cement cuttings are cleaned from the pits and the pits are filled with water before drilling is resumed.

From surface casing to completion above 10,000 feet. It is difficult to make generalizations about the mud program and drilling problems for the interval from 3000 to 10,000 feet. Depths to the top of the Wilcox vary several thousand feet over the large area and, even within a relatively small area, differences in lithology and formation pressures may significantly affect the mud properties needed for safe drilling.

Drilling is begun with the pits filled with water and as drilling progresses water is added to keep the mud

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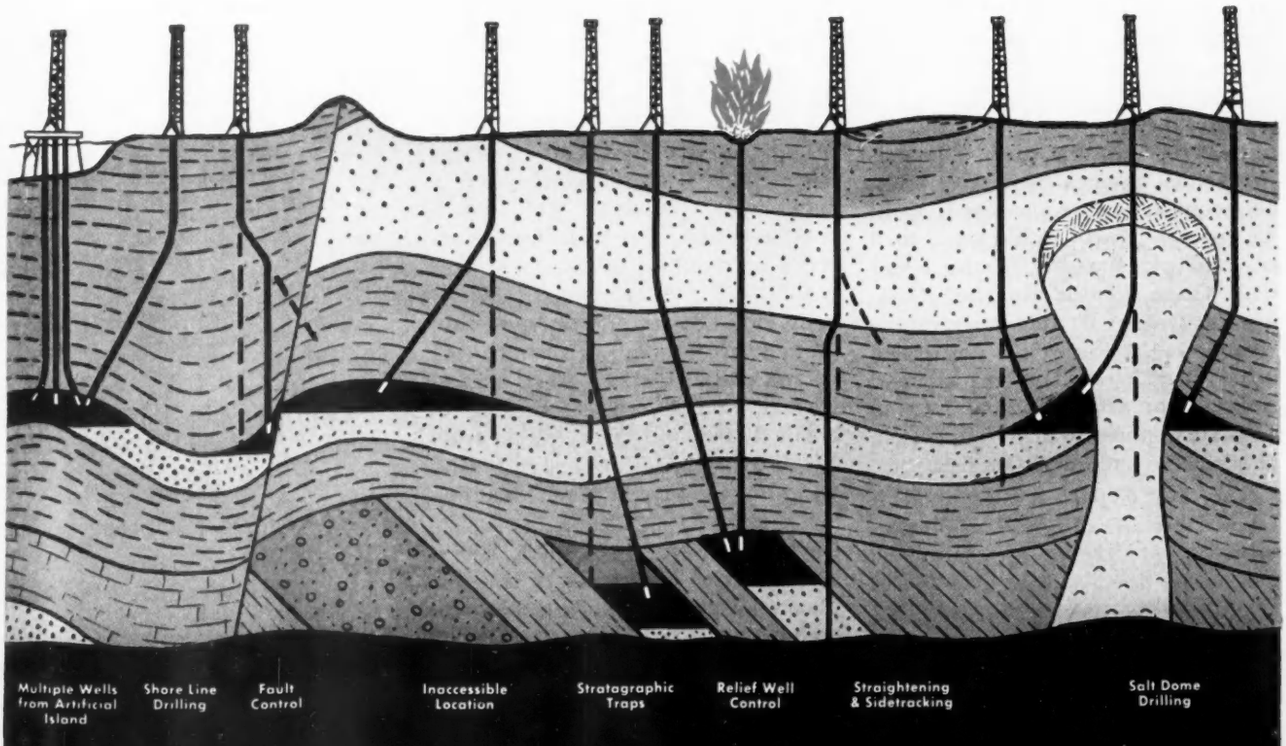

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weight below 10 pounds per gallon. Before the first trip is made, a small amount of caustic-tannin mixture may be added to the mud to disperse the clay and reduce thickness of the filter cake. At about 5000 feet, the addition of bentonite is begun in the amount of 3 to 5 sacks per tour. Caustic-tannin, or caustic-mined lignin (humic acid), is added in amounts of 50 to 100 pounds per tour. Mud properties at this time are roughly: weight 10 pounds per gallon; funnel viscosity 40 seconds; Stormer viscosity 25 cp; initial gel 0 g, 10-min gel 15 g; filtrate 15 to 20 cc; pH 9.

For the deeper wells, the mud program to be followed is initiated about 1000 feet above the top of the Wilcox. The programs in common use are: (1) treatment with bentonite, caustic-tannin and polyphosphate; (2) preparation of oil emulsion treated with caustic-mined lignin and tannin; or (3) preparation of lime-treated mud.

If the treatment with bentonite, tannin and polyphosphate is adopted, the amount of bentonite added per tour is increased to 6 to 8 sacks and about 50 pounds of caustic soda and 100 pounds of tannin are added per tour, along with 50 pounds of polyphosphate. The quantity of water added is decreased somewhat and the weight rises to 10.6 to 10.8 pounds per gallon. Funnel viscosity is 55 to 65 seconds; Stormer viscosity is about 45 cp; gels 0, 20 g; filtrate 7 to 9 cc, and pH 8 to 9. In the upper Gulf Coast (Texas Railroad Commission District 3) this program can be followed if the well is not drilled below 10,000 feet. The cost for mud is $5000 to $7000. From 30 to 45 days are required to drill from bottom of surface casing to 10,000 feet.

The use of oil-emulsion mud is favored because of improved bit performance and hole condition. So marked is the increase in rate of penetration with emulsion mud that some contractors offer to reduce the charge per foot if oil emulsion mud is used. Caustic-humic acid compositions, or caustic soda and mined lignins, or tall oil soap, are used to emulsify 10 to 12 percent by volume of diesel oil in the mud. After an initial treatment of about 4 pounds of emulsifying agent per barrel of mud, daily maintenance requires about 100 pounds of dispersing agent per tour, and somewhat more periodically whenever oil is added. Typical mud properties for this program are: weight 10.5 to 10.8 ppg; funnel viscosity 50 to 60 sec.; Stormer viscosity 30 to 40 cp; gels 0, 20 g; filtrate 5 to 7 cc and pH 9 to 9.5. Cost is about the same as for the bentonite treatment, $5000 to $7000. If pressures are normal, this program can be used to about 12,000 feet in the upper Gulf Coast and to about 9000 feet in southwest Texas.

For deeper holes, or when salt is added to reduce the resistivity of the mud filtrate, a lime-treated mud is preferred. Frequently oil is emulsified in the lime-treated mud. In converting to a lime-treated mud, water is added to reduce the clay content and avoid excessive thickening. Then 1 to 3 pounds of tannin, 2 to 3 pounds of caustic soda and 2 to 4 pounds of lime are added per barrel of mud. Mined lignin or calcium lignosulfonate may be used instead of part of the tannin. Pregelatinized starch (1 pound per barrel) or CMC (0.2 pound per barrel) may be added to reduce filtration. If an emulsion is prepared, mined lignin, or caustic-lignin composition, is added in the amount of 3 pounds per barrel of mud, along with 10 to 12 percent by volume of diesel oil. Normal treatment per tour is: 100 to 150 pounds lime, 100 to 150 pounds caustic-tannin or caustic-lignin, and 50 to 100 pounds starch or 15 to 30 pounds of CMC. With continued use, representative properties of the lime-treated mud are: weight 10.6 to 10.8 ppg; funnel viscosity 50 to 55 sec.; Stormer viscosity 30 to 40 cp; gels 0, 0 g; filtrate 3 to 5 cc and pH 12 to 12.5. When a lime-treated mud is used in drilling to about 10,000 feet, costs range from $7500 to $10,000, provided mud weight above 11 ppg is not required.

Mud programs for deep wells. The localized occurrence of zones of abnormal pressure requires that all records of wells in the vicinity be studied to properly plan the casing and mud program for a wildcat well. If no wells have been drilled near the proposed location, only then should any dependence be placed on a general program for the area.

In the eastern part of Railroad Commission District 3, abnormal pressures have been encountered about 10,000 feet. Casing should be set before drilling into the high pressure zone to prevent loss of circulation when the mud weight is raised as high as 15 ppg. A lime-treated oil-emulsion mud is desirable for further drilling.

In the southwestern part of District 3, conversion is made to lime-treated mud after 10¾-inch casing is set at about 6000 feet. The treating program has been described in the preceding section. Suggested mud properties for further drilling are shown in Table 1.

TABLE 1

Depth, Feet	Weight, ppg.	Funnel, Sec.	Filtrate API, c.c.
6,000	10.5	40–45	10
7,000	11.0	40–45	8–10
8,000	11.5	40–45	6– 8
9,000	12.0	45–50	4– 6
10,000	12.5	45–50	4
11,000	13.0	50–55	3– 4
12,000	14.0	55–60	3– 4
13,000	15.0	55–60	3– 4
14,000	16.5	60–65	3– 4
15,000	17.0	65–70	3

In southwest Texas, the problem of suggesting a general mud program is even more difficult. Depths at which abnormal pressures are found vary widely, as is illustrated by the tabulation of mud weights required in drilling wells in five counties along the Wilcox trend. (Table 2.)

TABLE 2

Depth Ft.	Live Oak ppg	McMullen ppg	Duval ppg	Webb ppg	Zapata ppg
5,000	10.0	10.0	10.0	10.0	10.5
6,000	10.5	10.0	10.5	10.5	10.7
7,000	11.5	10.5	11.0	11.0	11.0
8,000	16.0	11.5	11.5	12.0	12.5
9,000	16.0	15.0	12.0	12.0	13.5
10,000	16.0	16.5	16.0	12.0	14.5
11,000	....	16.5	16.0	12.5	15.0
12,000	.....	.....	16.0	13.5	15.0
13,000	.....	.....	16.0	16.5	15.5
14,000	.....	.....	16.0	.....	15.5

Other mud properties are much the same as those illustrated for District 3.

SPECIAL PROBLEMS

High pressures. The existence of abnormal pressures at widely varying depths is responsible for the vagueness and uncertainity of the mud programs previously outlined. In general, pressures in the Wilcox sands are normal (0.465 pound per square inch per foot of depth), or below normal, to depths of about 8000 feet. At greater depths in the Wilcox in South Texas, abnormal pressures are found so frequently as to become almost a "normal" occurrence. Examples are: Clay West field, Live Oak County,

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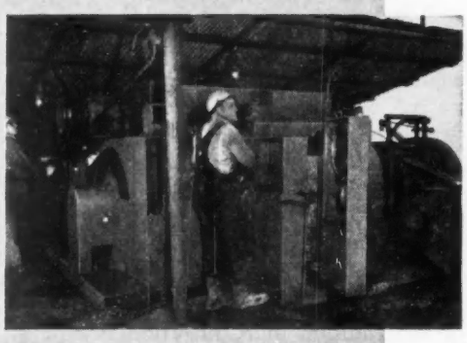

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6350 psi at 9450 feet; Hostetter field, McMullen County, 7854 psi at 10,250 feet; Hagist Ranch field, Duval County, 6975 psi at 9650 feet, and Zapata County, 6200 psi at 9689 feet. Many others could be listed but these are enough to point out the need for careful practices in exploratory drilling.[1]

Close attention to the drilling mud is essential to safe drilling operations in high pressure areas. Low-gel mud of adequate weight must be maintained. A consistent program of testing should be followed and reliable records kept of additions of water and all other constituents of the mud. Volume of mud in the pit should be held to the minimum safe level, for reasons of economy as well as for ease of handling. Mud in the pits should be stirred continuously to assure uniformity. But perfect mud is no substitute for good drilling practices.

The driller must be alert for signs of trouble. The driller usually is told how many feet to drill after a drilling break occurs before pulling the bit off bottom and pumping up returns. A gas detector installed at the flow line will operate an alarm when gas appears in the mud and will also furnish a continuous record of gas shows. The entry of fluids from the formation will be shown by a rise in the level of mud in the pit. A recording pit-level gage fitted with an alarm signal assures attention to changes in level of mud.

If mud is returning faster than it is being pumped in, immediate action must be taken to prevent a blowout. The blowout preventers are closed and the mud is circulated on a choke of such size as will allow return flow equal to the volume pumped in. Barite is added to the mud rapidly and uniformly, and care is taken to avoid "slugging" with 20 ppg mud which probably will cause loss of circulation. Bulk mud-handling equipment affords a means of adding barite uniformly at the rate wanted. The pumping rate and pit levels are watched to determine if flow is being brought under control.

Frequent measurements are made of weight of mud in the pit to make certain that gas is being released before the mud is pumped back into the hole. A degasser effectively separates the entrained gas from the mud.[2] If facilities for mixing mud are inadequate, the well must be shut in while a pit of heavy mud is mixed. When pumping is begun, the returns may be sent to the reserve pit until the heavily weighted mud reaches the surface. If the well cannot be brought under control with the heavy mud, either a barite plug or cement is pumped in to kill the well.

Sloughing shale. Trouble from sloughing shale frequently occurs some time after the shale has been drilled. Generally, the shallow shales are drilled rapidly with a mud having a fairly high filtrate (15 to 20 cc) without difficulty. Sometimes when the harder formations are encountered and drilling rate declines, trouble will be had from sloughing of the shale. Insufficient drill collars may allow the pipe to be put in compression and whipping of the pipe will break down the shale. Increasing the weight of drill collars will remove the cause of the sloughing and raising the viscosity of the mud will help clean the hole of cavings.

In other instances, difficulty has been found in drilling the shale because of balling of the bit and sticking of drill pipe. Remedial measures consist in reducing water loss and preparing an oil emulsion mud. Attention is given to keeping the bit clean by pulling off bottom and pumping at regular intervals. In general, mud weight is not raised in attempting to stop sloughing of shale because of liklihood of loss of circulation. The weight is held at about 10 ppg and viscosity is raised to about 60 sec. funnel. If there is opposition to the use of oil emulsion mud, filtration is reduced by CMC. Where the shale is bentonitic, as in the Helen Gohlke field, DeWitt County, only slight chemical treatment is needed to reduce filtrate to 5 cc. At the rapid drilling rate, water must be added in considerable amount to keep the mud weight below 10 ppg.

Loss of circulation. Loss of circulation is not considered a major problem in drilling along the Wilcox trend, although in some wells it is very troublesome and is responsible for a significant part of the mud cost. Mud often is lost in small amounts into the beds of sand and gravel which must be penetrated before surface casing is set. Common practice, as described earlier, is to begin drilling with bentonite mud gelled by a small amount of lime and to continue the addition of bentonite and lime as necessary to maintain high viscosity and gels while adding water to keep the weight low. This procedure usually is adequate to prevent excessive loss of mud but occasionally returns are lost completely. Then a pit of mud is prepared with bentonite and lime. Fibrous, flake or granular materials are added to make as thick a suspension as can be pumped. Returns usually are regained after the thick slurry has been pumped into the gravel zone.

After surface casing has been set through the gravel and coarse sand sections, no more losses occur to cavernous or highly porous formations but thereafter mud may be lost as a consequence of increasing mud pressure to exceed the structural strength of the formation. The excessive pressure which causes loss of mud into fissures usually is attributed to building up mud weight but contributing factors may be pressure caused by pipe movement, balling of the bit, and inadequate clearance in the annulus[3, 4] The maximum mud weight which can be used without loss varies widely in different regions and even within a limited area. In the Provident City field, Lavaca County, there is no loss of mud weighing 12 ppg, while in the Sublime and New Ulm fields in Colorado County 10.5 ppg is the maximum weight. Severe losses may occur when mud weight becomes too high as a result of rapid addition of barite in stopping a gas flow. When a well is kicking, care should be taken not to raise weight too high in the haste to kill the well. Often the difference between intrusion of gas and loss of mud is only a few tenths of a pound per gallon in mud weight. Under such conditions particular attention must be given to movement of pipe in the hole and maintenance of mud of low gel strength. A degasser is very helpful in preventing recycling of gas-cut mud.

The means used to stop loss of mud vary, of course, with the conditions responsible for the loss. The first step, if possible, is to reduce the mud weight. If returns are not secured at the minimum safe mud weight, a 50 to 200 barrel batch of mud is mixed containing 15 to 20 pounds per barrel of fibrous, flake or granular material (or mixtures of these) and the batch is placed in the zone of loss. Pipe is pulled above the zone of loss before

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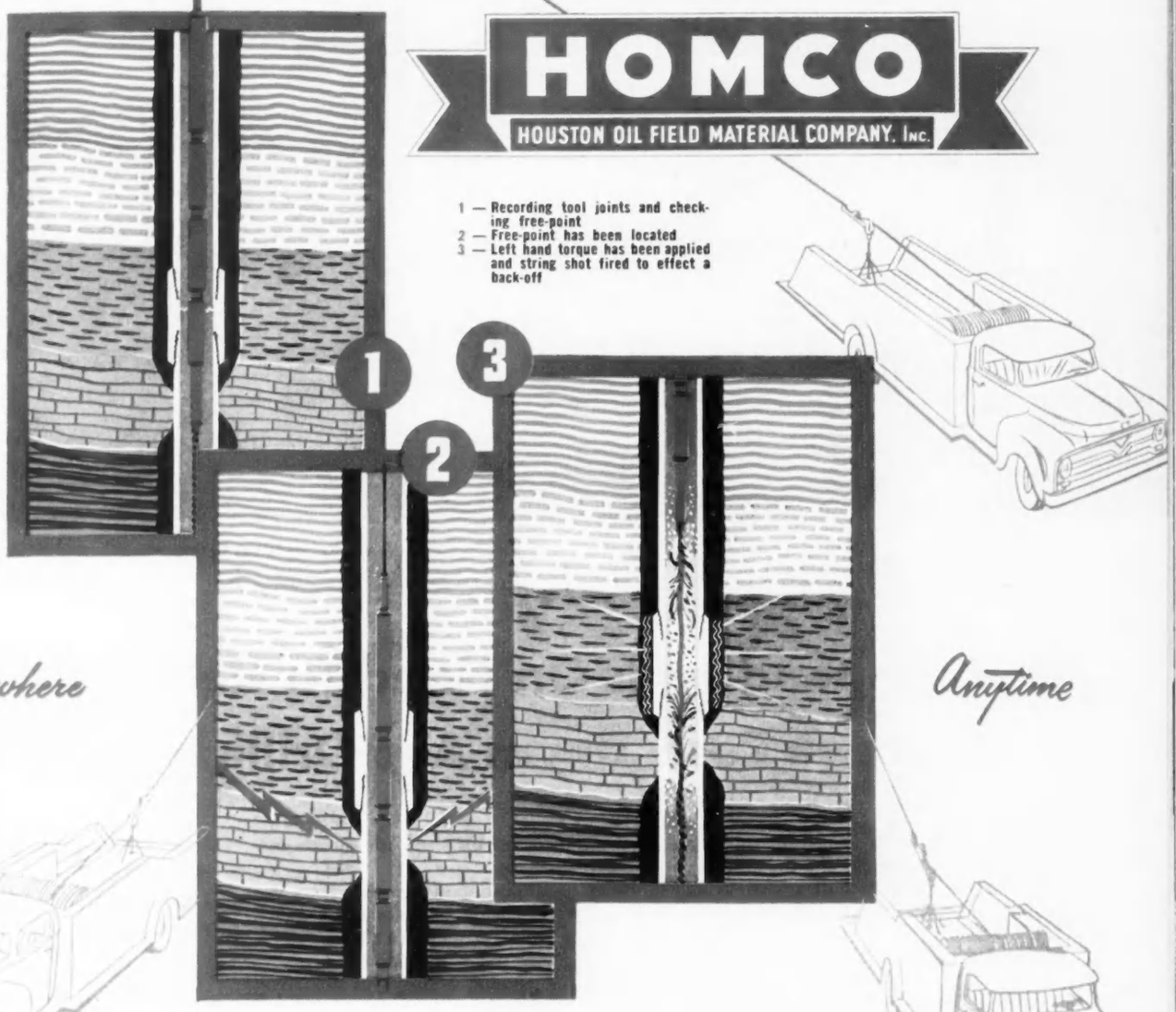
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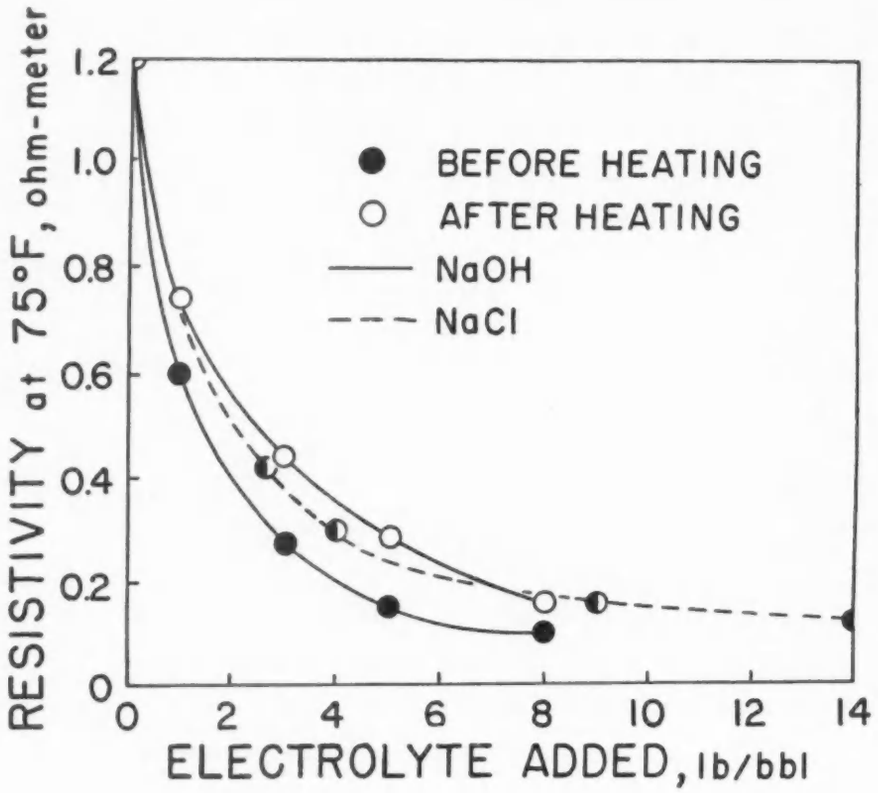


FIGURE 1—Changes in resistivity of field muds containing sodium chloride or sodium hydroxide after heating 16 hours at 225° F.

beginning circulation and then the bit is gradually worked to bottom. Infrequently it is necessary to use plugs of bentonite-in-oil or gel cement. Before loss of mud occurs, mica or walnut shells ground fine enough to pass the screen of the shale shaker may be added as a preventive measure.

Control of mud resistivity. In the upper Gulf Coast, interpretation of electrical logs of the lower Wilcox is complicated by the presence of lignite streaks, lignitic shales, and by invasion of mud filtrate into the sands. Invasion of filtrate of high resistivity (order of 1 ohm meter) is particularly objectionable because of the low porosity and the nature of the formation. Significant improvement has been made in the quantitative evaluation of electrical logs by using mud of controlled resistivity and low filtration in conjunction with the focused type of resistivity measurement.[5,6] Because the magnitude of the self potential decreases with decrease in mud resistivity, a lower limit is imposed on resistivity. Experience has shown that if the mud resistivity is held at four or five times that of the water in the formation, the self potential curve on an amplified scale is adequate and the objectionable effect of invasion of filtrate is greatly diminished. The reliability of the quantitative estimations based on the SP curve is improved because of the smaller contrast between the resistivities of the filtrate and the interstitial water.

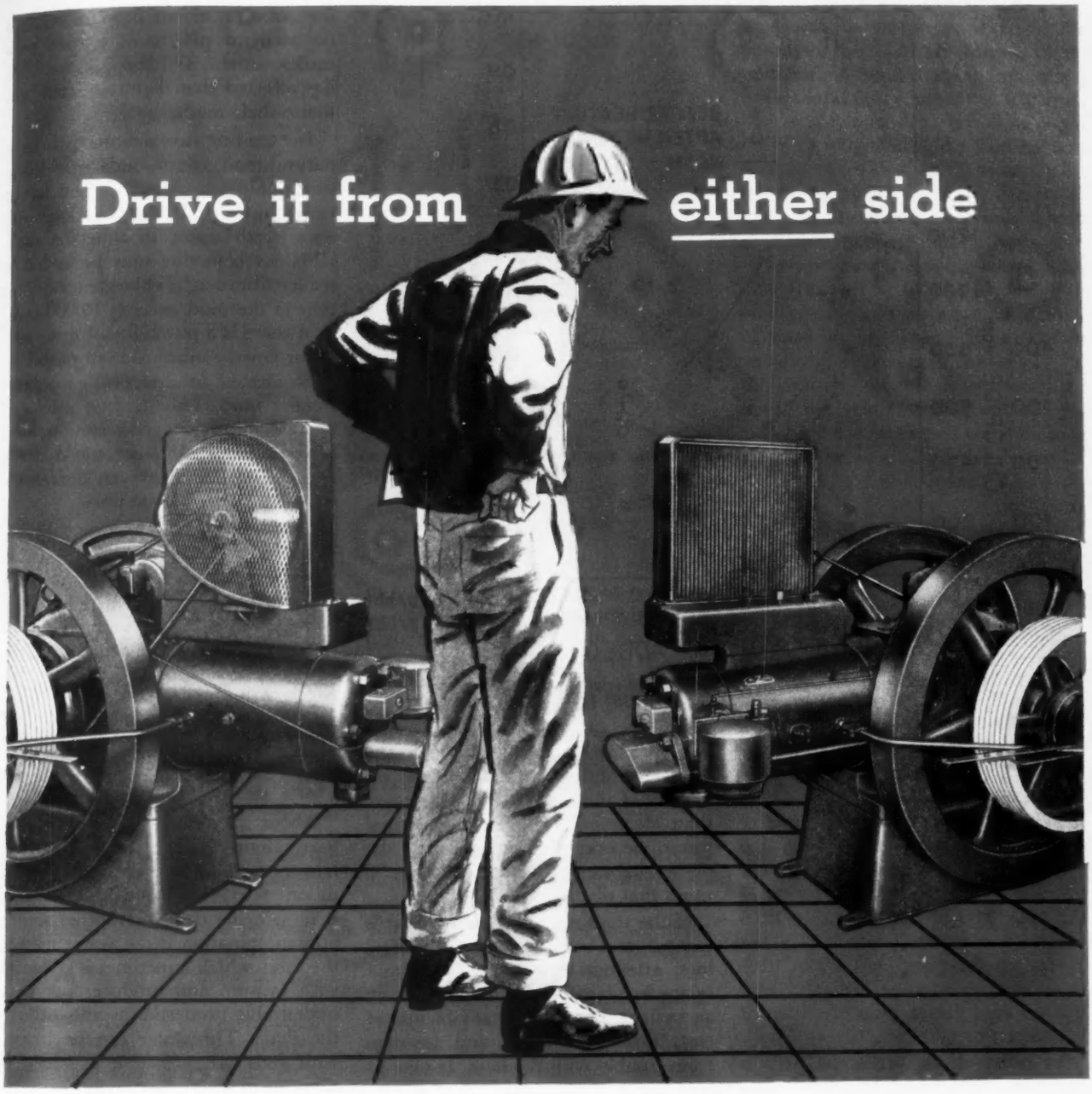
The resistivity of the interstitial water varies along the Wilcox trend and also varies somewhat with depth, ranging from 0.16 to 0.025 ohm meter measured at bottom hole temperature. Although resistivity of the mud filtrate is the property which should be adjusted by chemical treatment, measurement of resistivity of the mud at surface temperature usually is adequate for satisfactory control. Resistivity of filtrate at bottom hole temperature can be estimated from charts, provided sodium chloride is used to lower resistivity. In making quantitative calculations from electrical logs, resistivity of both mud and filtrate should be measured at a specified temperature when the logs are run.[7]

The addition of any electrolyte lowers the resistivity of the mud but a stable value of the resistivity under bottom-hole conditions requires that the electrolyte not react with the constituents of the mud or with the formation invaded by the filtrate. Figure 1 shows the effect on the resistivity of a field mud of adding sodium chloride or sodium hydroxide, and the changes in resistivity which occurred when the muds were heated 16 hours at 225° F. Practically no change in resistivity occurred on heating the samples treated with salt, while the resistivity of the samples treated with caustic soda increased 25 to 75 percent. The alkali reacted with the clay and sand in the mud, causing the increase in resistivity. That such a reaction may cause a large change in resistivity of mud filtrate is evident from Figure 2, in which is shown the results of heating solutions of sodium chloride and of sodium hydroxide with diatomaceous earth (silica) in airtight containers. After heating 16 hours at 225° F., alkalinity of the sodium hydroxide solutions heated with the silica had decreased, with a corresponding increase in resistivity, while there was no significant change in the concentration or resistivity of the sodium chloride solutions. Another portion of the most concentrated sodium hydroxide solution was unchanged in concentration after heating without the silica.

From the standpoint of ease of control of properties, lime-treated muds are the most satisfactory for maintenance of low resistivity.[8] Salt can be added to lime-treated muds without an objectionable increase in gel strength. Filtration can be reduced as low as wanted by addition of starch. A stable oil emulsion can be made using as dispersing agents the thinners employed to control viscosity. Usual practice is to change to lime-treated mud at the top of the Wilcox or somewhat above that depth. As described earlier, calcium lignosulfonate can be used in the breakover and caustic-tannin and caustic-lignin used for regular treatment.

The amount of salt required ranges from 1.5 to 6 pounds per barrel, depending upon the resistivity wanted. In Colorado County, for example, resistivity of interstitial water at 9000 to 10,000 feet is about 0.02 ohm meter and resistivity of mud is adjusted to between 0.2 and 0.3 ohm meter at surface temperature. If the lime breakover is made some distance above the top of the Wilcox, the salt may be added at the rate of 200 or 300 pounds per tour until the resistivinstead of adding all of the salt at one ity is decreased the desired amount, time.

As drilling progresses, salt is added in such quantity as to keep the re-



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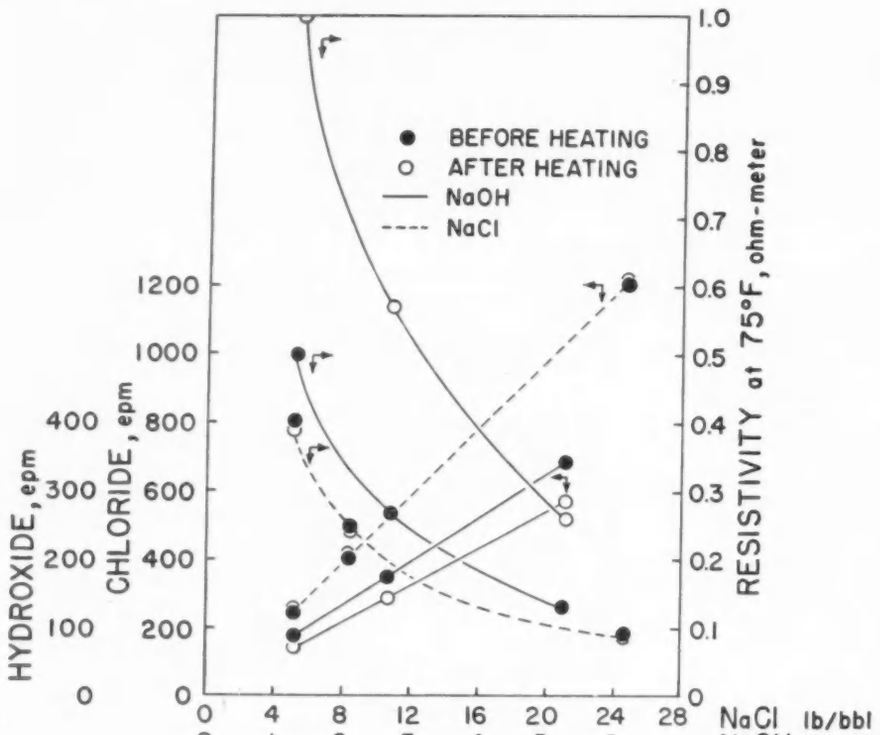


FIGURE 2—Effect of heating solutions of sodium chloride and solutions of sodium hydroxide with diatomaceous earth (16 hours at 225° F.).

sistivity constant. Resistivity of the filtrate should be measured occasionally as a check on the control of mud resistivity. Typical properties of mud of controlled resistivity are: weight 10.6 ppg; funnel viscosity 55 sec.; Stormer viscosity 35 cp; gels 0, 2 g; filtrate 4 cc; pH 12.5; filtrate alkalinity Pf 3 cc; chloride 6000 ppm. Cost of the controlled resistivity mud is but little more than that of the ordinary lime-treated mud and savings are effected in completion costs.

In other areas, high resistivity is desired in order to get greater detail in the SP log. For example, in exploratory drilling in Refugio County, difficulty was had in determining from the electrical log where to make drill stem tests in a well logged with strongly alkaline lime mud in the hole. Resistivity of the mud was about 0.2 ohm meter at 100° F. In a second well, the resistivity of the mud was kept at 1.6 ohm meters at 100° F. by using only a moderate treatment of caustic-tannin and caustic-lignin, along with more water to control viscosity. The difference in magnitude of the SP in the sand and shale sections was several times as great as in the first well and there was no uncertainty about the zones to be tested.

For best results with the induction log, two conditions are imposed on the resistivity of the mud. First, the resistivity of the filtrate should be more than 10 times that of the interstitial water. Second, the resistivity of the oil-bearing sand should be less than 50 times that of the mud.

If the mud engineer knows what is wanted to obtain the best electrical logs, attention can be given to that factor in planning the mud program, as well as to the dominant factors of cost, ease of control, and freedom from trouble with the hole. It may be expensive to make significant changes after a mud program has been adopted. Thus, the resistivity of a fresh water mud can be lowered with only a little advance planning but to raise the resistivity of a salty mud may require the replacement of a substantial part of the mud.

Contamination by salt and anhydrite. In Wilcox drilling, contamination of mud by salt occurs only as a result of a salt water flow. No beds of salt are drilled. The first step in control, of course, is to raise the density of the mud high enough to stop the influx of salt water. Treatment then is begun to counteract the effect on the mud. Lime-treated muds withstand a higher concentration of salt without serious flocculation than do medium pH muds treated with caustic-tannin, and these, in turn, are less affected than lightly-treated bentonite-shale muds.

In treating a medium pH or a natural mud, caustic soda is added to raise the pH to about 10, and tannin or lignin, or both, is added along with some fresh water to thin the mud. CMC or bentonite may be added to reduce filtration. If chloride concentration in the mud exceeds 10,000 ppm, or if there is a possibility of more salt-water flows, control of mud properties is facilitated by converting to lime-treated mud. Lime-treated mud can be maintained in good condition by adding caustic soda, organic thinners, and starch or CMC, even though the salinity reaches 50,000 ppm.

Contamination of the mud by anhydrite is evident only in South Texas, where the anhydrite occurs in stringers and veins in shale above the Wilcox. Anhydrite causes an increase in gel strength, gel rate, and filtration of the lightly-treated muds in use at that depth. From 0.5 to 2 pounds of soda ash per barrel of mud, along with about 1 pound of organic thinner, reduce gels and filtrate. Polyphosphates also are effective.

About 25 pounds of soda ash per tour, along with the usual chemical treatment, will keep the mud in condition while the anhydrite-bearing shale is being drilled. Another source of contamination is the water used in the mud, which sometimes is saturated with gypsum and produces the same undesirable properties as anhydrite in the shale. The water can be treated with soda ash before it is added to the mud, or the mud can be treated as already described.

High temperatures. High temperatures in deep wells create problems in the control of mud properties.[9] High temperatures affect the components of the mud by increasing gelation of clays; decomposing dispersing agents; degrading organic filtration-reducing materials, and accelerating the reaction of alkalies with the siliceous constituents. These alterations tend to produce thick muds having high filtration rates. Such muds interfere with drilling and completion operations in many ways, for example, by requiring extreme pressures to break circulation after a trip; by sticking drill pipe and testing tools; by preventing logging

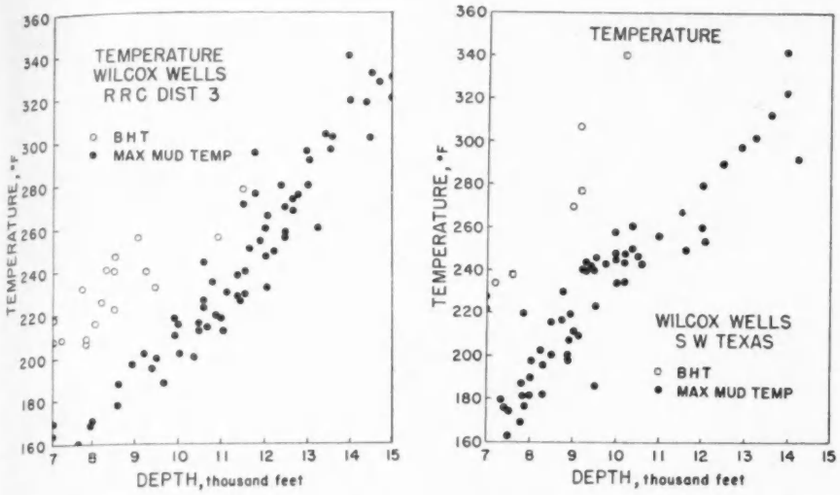


FIGURE 3—Comparison of mud temperatures measured on electrical surveys with bottom-hole temperatures: (A) R.R. Com. Dist. 3, (B) Southwest Texas.

and perforating tools from reaching bottom, and by sticking packer and tubing in completed wells.

The temperature gradient in fields along the Wilcox trend ranges from 1.7 to 2.3 degrees per 100 feet.[10] Figure 3 shows some bottom-hole temperatures in Wilcox fields and also a number of measurements of mud temperatures made while running electrical logs. Temperature of the mud in a drilling well rarely, if ever, reaches that of the deepest formation exposed, and bottom-hole temperatures may be 20 to 50 degrees higher than the maximum mud temperature measured. While no definite temperature can be set at which temperature becomes a serious problem in mud control, difficulties frequently are noted at about 250° F.

The effective life of polyphosphate thinners is reduced materially as the temperature approaches 200° F. Accordingly, phosphates are but little used deeper than 10,000 feet in District 3, or below 8000 feet in southwest Texas. Quebracho and mined lignin are more stable, although they show evidence of breakdown at 325 degrees. Starch is less effective than CMC in maintaining low filtration at high temperatures.

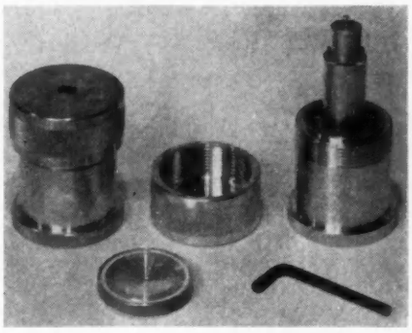
Caustic soda and lime in strongly alkaline muds react with the clays and sand present to form calcium silicates of uncertain composition. These products cause the mud to solidify on standing at high temperatures.[11] Stability of lime-treated mud at high temperature is improved by keeping the concentrations of caustic soda and lime low.[12,13] Low clay content is desirable, and also a moderately high concentration of organic dispersing agents.

Successful control of mud properties in hot holes is dependent on a regular program of testing at temperatures higher than that to which the mud is being subjected while drilling.[14] A fair estimate of performance can be made on the basis of such tests.[15] The behavior of mud at bottom-hole temperature cannot be predicted reliably from tests made at flow line temperature. Pilot tests are employed to determine the course of future treatment. Figure 4 shows equipment used by mud engineers in making such tests. In the routine testing program, particular attention is paid to alkalinity and solid content.

Control of solid content of mud. It has long been recognized that not only the quantity but also the composition and structure of the suspended solids are important in the regulation of mud properties. Increasing attention has been given in recent years to control of the solid content of mud. The desirable features of "low solids" muds have been extolled without defining the term and comparisons have been made between "low solids" and "high solids" muds without stating the percentage of solids in either.

With the introduction of oil emulsion muds, field equipment was devised to determine oil, water, and solid content. In this apparatus (Figure 5) the oil and water are distilled from a measured volume of mud. The volumes of the condensed oil and water are measured and the volume of the solid is found by difference. The average specific gravity of the solid then can be calculated from the density of the mud. The routine measurement of solid content affords a background of experience which is particularly useful in controlling properties of weighted muds. The amount of shale solids in a weighted mud cannot be estimated from the density of the mud, as can be done in unweighted muds not containing oil.

The necessity for using barite (specific gravity 4.3) instead of clay (specific gravity 2.6) to raise the density of mud above 11 ppg is generally recognized. Sometimes, however, in the routine treatment of weighted muds the relations between specific gravity of the solids, the volume occupied by the solids, and the density of the mud, are overlooked. The rela-



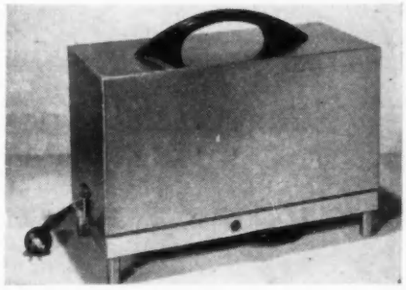


FIGURE 4—Storage cells and oven, equipment used by mud engineers in testing performance of mud at high temperatures.

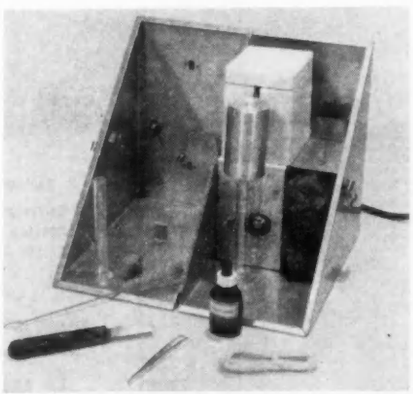
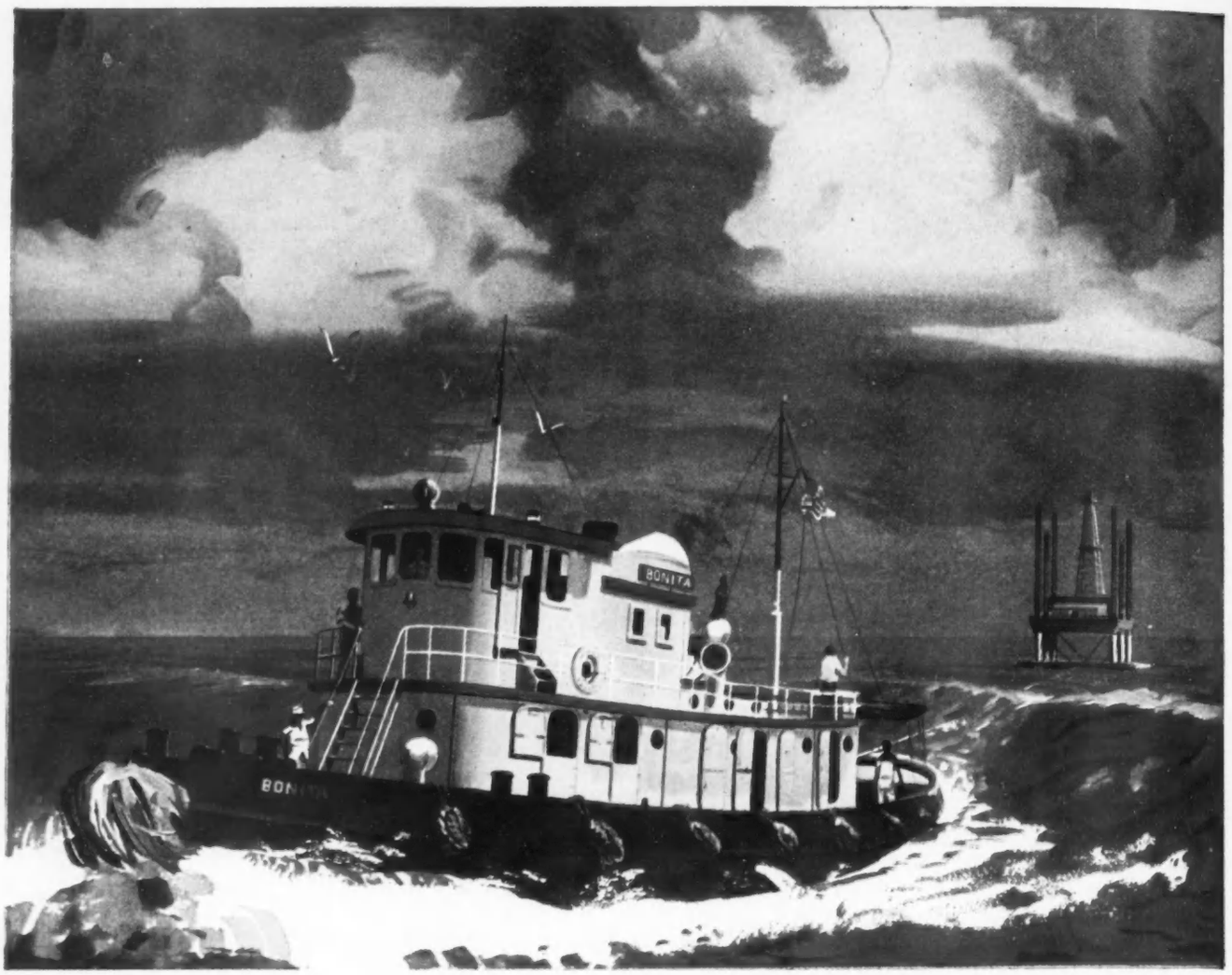


FIGURE 5—Retort used to determine liquid and solid content of mud.



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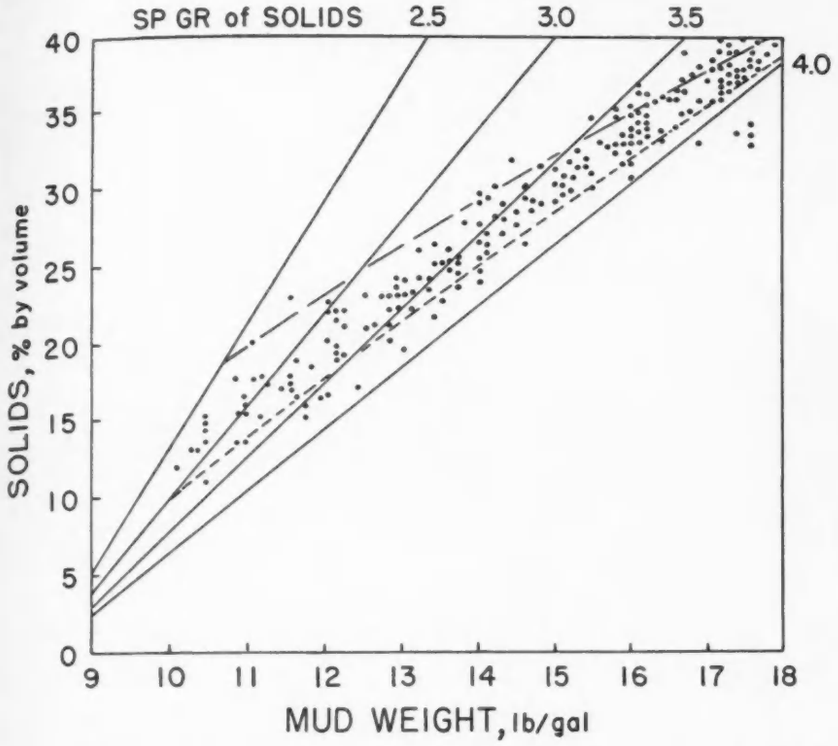

FIGURE 6—Relation between specific gravity, mud weight and percentage by volume of solids in the mud. Data points are measured solid contents of field muds.

tions between these quantities are shown in Figure 6 for specific gravities of 2.5, 3.0, 3.5, and 4.0 and for mud weights of 9 to 18 ppg

On the same chart (Figure 6) have been plotted the results of numerous determinations of the solid content of muds ranging in weight from 10 to 18 ppg. These data are measurements made in the field on muds considered representative of the fresh-water muds in common use in the Gulf Coast. Included are many examples of the types of mud used in drilling along the Wilcox trend. Most of the muds had been in use for some time and the heavier muds, in general, had been thinned as much as possible by chemical treatment.

Two dotted lines have been drawn on the chart. The upper line indicates an upper limit of volume of solids for satisfactory control of flow properties, while the lower line is suggested as a more desirable composition from the standpoint of ease of control. It is not meant to infer that any mud having a solid content above the upper line is defective in performance nor that one having a solid content below the lower line is intrinsically superior. Most of the muds having higher solid content than recommended here were performing satisfactorily at the time of the test but would tolerate only a slight increase in solids. Some muds having less solids had higher funnel viscosities but these muds could be thinned by chemical treatment, and others showed evidence of settling which could be stopped by adding a small amount of CMC.

Often too little attention is paid to the solid content of the mud while drilling the shallow hole. The solids from the formations drilled are allowed to accumulate in the mud and increase the weight. Loss of circulation may result from increase in weight, as already discussed. Trouble from tight hole may be caused by thick, high-solids filter cake deposited on sands. Drilling rate may be increased by keeping the solid content of the mud low.[16] A survey of mud records for several wells drilled by the same contractor in a field in DeWitt County gave evidence of improved drilling rate with mud of lower content of shale solids. Emulsion muds, containing about 10 percent oil, were used in all wells and mud properties, except weight, were similar: funnel viscosity 45 to 50 sec.; Stormer viscosity 40 to 45 cp; gels 0, and 5 to 10 g; filtrate 4 to 6 cc; and pH 9. For three wells, average solid content of the muds was 17.5 percent by volume and weight was 10.5 ppg, and for three other wells, solid content was 13.3 percent by volume and weight was 10.0 ppg. Actual drilling times were not shown on the mud records but the elapsed time for the interval from about 5000 to 8000 feet for the wells drilled with 10 ppg mud was only two-thirds that for the wells drilled with the mud of higher solid content.

The solid content of weighted muds cannot be controlled economically by dilution with water, as can be done with the natural shale muds. Chemical treatment of weighted muds is directed toward reducing the amount of drilled solids which are incorporated in the mud. Lime-treated muds are favored because they tolerate a high content of shale solids without excessive increase in viscosity. Increase in solid content aggravates the problems of gelation and solidification at high temperatures.[11]

The centrifuge affords a means of reducing the volume of suspended solids by removing shale solids from heavily weighted muds while retaining the barite.[17] By removing the clay, the problem of controlling the flow properties of the mud is diminished. Less chemical treatment is necessary. Because of partial removal of clays, control of filtration depends principally on organic colloids such as CMC.

ACKNOWLEDGMENT

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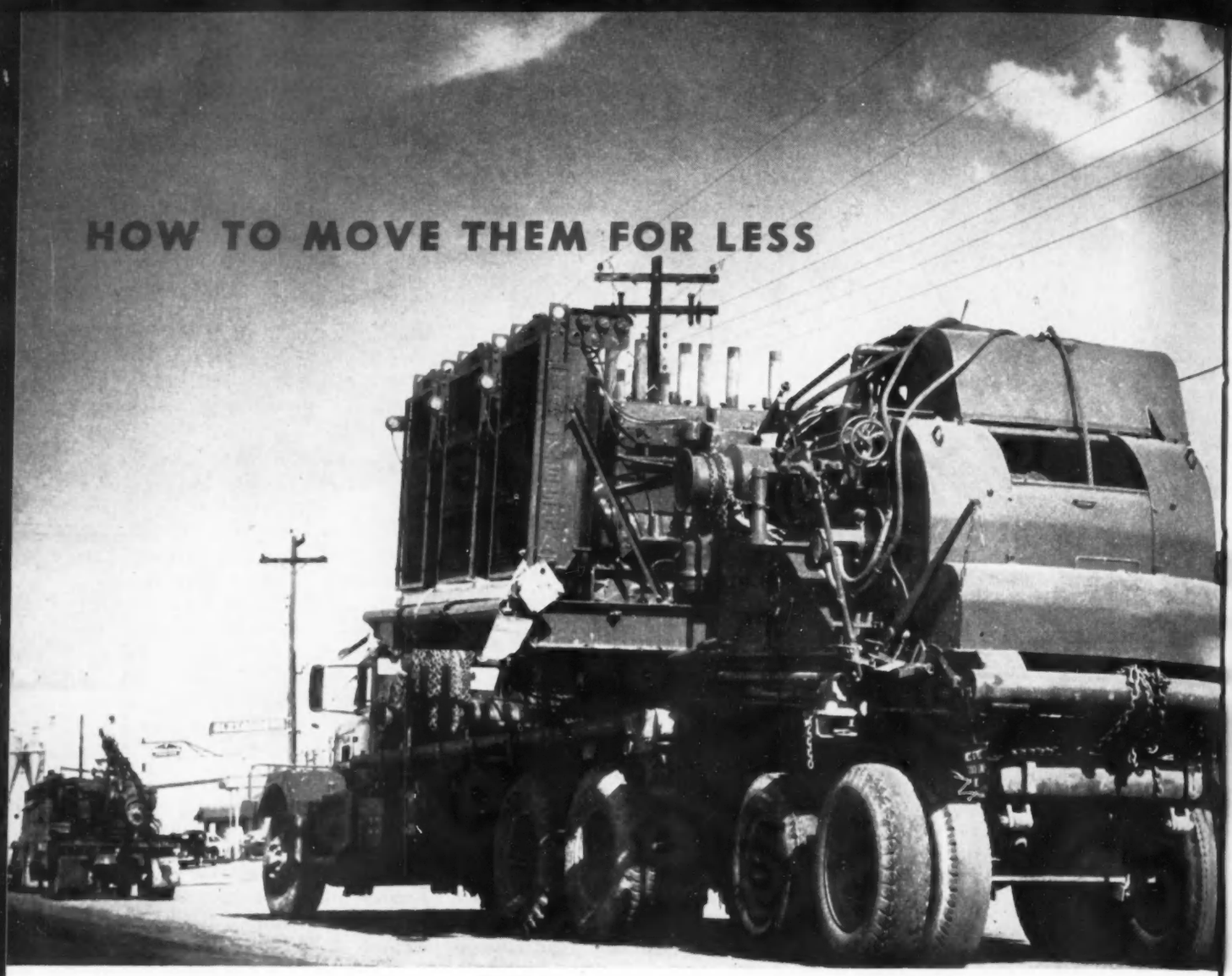


RIGS ON THE MOVE

Soaring costs accompany the ill-planned rig move. Low-cost transportation is one of the most closely coordinated projects in the industry, involving drilling, construction, transportation and production representatives.

By O. MATHENY,
Cascade Drilling Company, Canada

THE MANNER in which a rig is rigged up makes a great deal of difference in the ease and speed of the moves. In the case of a medium sized rig capable of drilling from 5000 to 7000 feet, under average conditions, a move may be anticipated every 25 to 45 days.

There are numerous factors which affect the efficiency and economy in moving. There are other ideas that will help move a rig faster and cheaper. (See Page 119.)

New equipment. Equipment manufacturers have the same prime interest in mind, and have made some radical changes in the design of machinery in recent years.

The new built-together block and hook combination is a good example. The standard four leg derrick which had to be torn down and erected by rig builders, has been almost entirely replaced by the portable drilling mast. These new masts can be taken apart, put together, raised and lowered in a matter of hours, whereas for standard derricks, it was a matter of days.

The trailer rig is something which has come into being only in the past few years and today almost every rig manufacturer is building a trailer rig of some sort. These rigs have a very definite advantage over types of conventional equipment in moves where the mast can be lowered and left on the rig while being moved.

New trucks. While drilling equipment was growing from the old jackpost rig into the modern ones of today, moving equipment has experienced the same advancement.

The newest trucks are designed and rigged up with the same prime in-

terest in mind as are the rigs; faster holes and faster moves. Usually when a pusher gets a poor move it is the fau't of something other than the moving equipment.

The larger trucks have their drive wheels in tandem, transmission capable of 10 to 15 speeds which gives sufficient power or speed for any situation; two or three speed winches, long beds, with a rolling tailboard which makes it possible to pick up heavy loads with a greater safety factor.

Another common way for both medium and large trucks to be rigged up is with a short wheel base tractor and a long flat-bed trailer, more commonly called a float.

This arrangement makes it possible for a truck to load without the help of a second truck as all trucks nowadays are equipped with winches and gin poles.

Besides the trucks, are the dolley wheels or Athey wagons, which are used to skid a complete rig where the terrain and conditions will permit. This takes four sets of wagons or wheels, one for each corner of the rig. A large beam is placed through the substructure between each set of wheels then the rig is raised up and the beams are placed on top of the wheels. The best arrangement is the surplus airplane wheels rigged with a hydraulic jack on each set of wheels. This eliminates having to jack the rig up by some slower process.

Organizing the move. The organizing of a rig move is the pushers' job. Information regarding the location and roads should be obtained.

In case of a long cross-country move, the road should be travelled by the truck pusher so as to know the actual condition. In many cases the trucks have to be routed according to their size and the weights of loads. Truck drivers should be given specific information needed to get his load to its destination. Usually a truck that is lost draws the same money as all the rest.

The location should be leveled, cellar dug and matting boards laid so that as soon as the rig arrives, it can be placed where it is to be rigged up.

A move actually should start by getting a rig ready to move. It usually takes two trucks and a crew of men about 3 to 4 hours to get ready. The steam and water lines should be taken up and stacked, the pre-fabs torn down and put in racks, the floor cleaned and the derrick laid down and made ready to take off. Then when the rest of the trucks arrive, the derrick and drawworks can be taken off and the rig is ready to be loaded and moved.

The crews, rigpusher, and truckpusher, working together and everyone knowing his job, is a must in a good rig move. It's also a big help to have a truckpusher that is familiar with the rig and the way it is rigged up.

On the move. The first loads, of course, are the substructures, the drawworks and engines, then the derrick. The next loads will be the buildings and accessories.

The location should be so arranged

Continued on Page 127

These factors mean money on moves . . .

- Which side of the derrick leg is the stand-pipe.
- How are the mud lines connected into the substructure.
- How the drawworks are fastened down.
- How the mud-pump belt guard, rotary guard and all other guards are constructed and installed.
- What type connection there is between mud pump and mud tanks.
- How the catwalk and pipe racks are constructed and arranged.
- Where tool boxes are and how many.
- Type of lights and how installed.
- Manner in which water and fuel tanks are constructed, position with reference to rest of rig.

These ideas make moving easier . . .

- A water and fuel tank arrangement where a round or square fuel tank is telescoped down into a square water tank. The operation of this arrangement of tanks is made possible by a series of pullies and is operated by a small winch truck. It is not necessary to unload the fuel tank provided it is properly baffled, unless the added weight of the fuel is a factor. A water tank of course is always empty when being moved.
- Catwalks constructed so that they form a junk-rack when turned upside down.
- A boom fastened to one of the back derrick legs with a pulley on the end and a rope or wire-line through for handling prefabs.
- A steel house 7½ to 8 feet in width by 24 to 28 feet in length, housing the light plant, spare air compressor, water pump, tool boxes and crew's lockers. This is quite common on most of the rigs in Canada, and does not require any additional heating in the winter months as the heat from the light plant is sufficient.
- Racks for the prefabs. These speed up the handling of prefabs considerably, and they are also very effective on cutting down breakage.
- The blowout preventer manifold with the accumulator or nitrogen bottles rigged up on steel skids, or enclosed in a small steel house. In some cases these items are built into the substructure.
- Tool boxes or change houses built into the substructure.
- The boilers which are used for heat and cleaning purposes only are unitized and built into a steel house, rigged up with the injectors and feed pumps fixed stationary onto the boiler-house floor. In many cases the water pump will be placed in the boiler house also.
- Three or four compartment oil tanks on steel skids with a steam line run through the bottom center and a hook in the top center for ease of handling. This unit prevents the necessity of handling numerous oil drums.
- Slings made up for handling the rotary table, kelly, or other objects which take time and are hard to tie a winch line onto properly.

Many oil field trucks specially equipped for oil well work weigh almost as much empty as the maximum weight allowed in North Dakota.

Don't Truck Through North Dakota Unless . . .

You are familiar with the strict regulations that make this state different from all the rest. Here are the facts.

By ALLAN M. SHIRLEY, Secretary-Manager, North Dakota Motor Carriers Association

With an average of eleven trucks required to move the average drilling rig to a new location, trucks are important to the industry. Like other industries, oil field trucks are regulated by state and federal governments. North Dakota is no exception. Here, trucking is governed by laws passed by the state Legislature and Congress and by the many rules and regulations prescribed by various departments, bureaus, and commissions.

Truck regulations in North Dakota are many and apply to all trucks whether operated upon open highway, within a municipality, or in oil fields. They vary from neighboring states and differ with those governing trucks in other oil states.

Ten weighing stations. North Dakota's size and weight regulations are enforced rigidly. There are ten State Highway Department weighing stations located at strategic places and operating 24 hours a day. In addition there is a special Highway Department automobile assigned to each scale. Radio equipped and manned by special deputies, such cars travel the back roads in the vicinity of the scales to prevent trucks from bypassing state weighing stations.

It is at such stations that trucks are measured and weighed to see if they are within North Dakota laws. The personnel at such state scales also determine if vehicle is properly licensed and comes under reciprocity if from out of state.

Width, height, length. Maximum width of trucks is limited to eight feet. Height is restricted to 12 feet, 6 inches. Over-all length of combinations (tractor, semi-trailer, or truck full-trailer) is limited to 47 feet, 3 inches. Straight trucks are limited to 36 feet, 9 inches.

Gross weights. Gross weights are determined by a formula, but in no case shall load exceed 18,000 pounds on a single axle or 30,000 pounds on tandems. Nor shall any wheel load exceed 550 pounds per inch of tire width. Tandem axles are described as being over 40 inches apart and less than 8 feet apart.

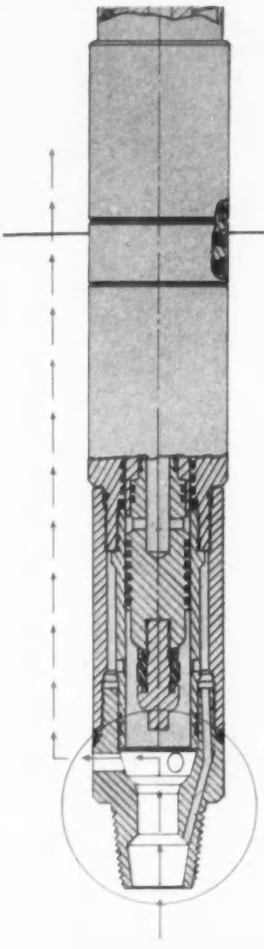
The formula for determining gross weights is in two parts. The first part is for determining gross load when distance between front steering axle and rearmost axle on truck or trailer is over 18 feet apart. The second part applies whenever the first axle and last axle of any group of axles on a vehicle or combination is 18 feet or less apart.

Under the first formula, (axles over 18 feet) the distance between the first (steering) axle and last axle plus the factor 40 multiplied by 750, will determine total gross load. To illustrate: A truck semi-trailer combination is 47 feet 3 inches from bumper to bumper. This particular unit has 5 feet of overhang (distance between center of front hub cap to bumper, and similar situation at the rear). Deducting the 5 feet overhang from over-all length, leaves 42 feet 3 inches from center of front steering axle to rear-most axle on the combination. Adding the factor 40 to length of 42 feet 3 inches giving us total of 82.3. By multiplying 82.3 by 750 we get total of 61,725. This is the legal total gross weight of the vehicle in this illustration.

The second formula applies to those instances when a group of axles are less than 18 feet apart. In such cases the distance between the axles under consideration is added to the factor 40. The total of same is then multiplied by 650. This is legal weight of the axle group under consideration.

Some trucks have been designed to reduce overhang to only 3 feet, with over-all length of 47 feet 3 inches, they legally gross out at 63,225 pounds in North Dakota.

Oversize violations. Violations for overwidth, overheight and overlength



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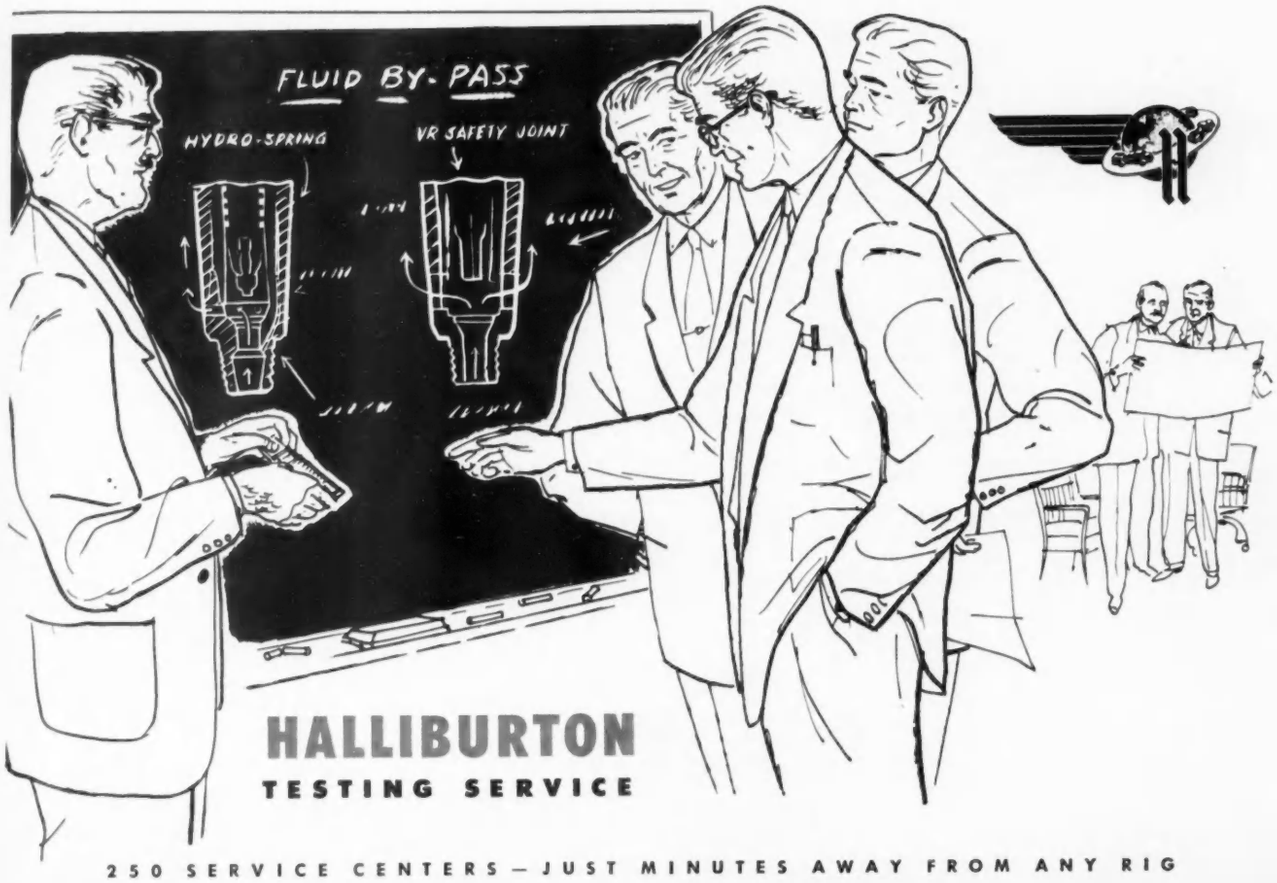

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are considered misdemeanors in North Dakota and subject to fine of not more than $100 or by imprisonment in county jail for not more than 30 days or by both fine and imprisonment.

Overweight violations. Overweight violations are subject to special law. There is no fine for the first 1000 pounds of overload, this being considered as a tolerance for shifting loads, ice, snow, mud, or human error in determining weight of freight.

After that however, a fine of 1 cent per pound applies to each pound of overload when excess is 2000 pounds or less. Fine is 2 cents per pound for overload 2001 to 3000 pounds; 4 cents per pound for 3001 to 4000 pounds overload; 6 cents per pound for 4001 to 5000 pounds overload; and high of 10 cents per pound for each pound of overload over 5000 pounds.

Special permits. For good cause, the North Dakota Highway Department will grant special permits authorizing movement of oversize and overweight trucks over designated routes. These are issued on a one-trip basis only. There is no fee for such special permits nor is there limit to the number issued. Special permits for oversize and overweight vehicles may be obtained from the State Highway Department at Bismarck or at any of its division offices at Dickinson, Williston, Minot, Devils Lake, Grand Forks, Fargo, and Valley City.

A complete drilling rig, grossing over 150,000 pounds, is skidded across a North Dakota prairie to another location. You need special permits to cross highways; then the roads must be planked.

Except during spring months when roads are restricted, the Highway Department has cooperated fully in the issuance of oversize and overweight truck permits for oil field operations. The state recognizes the importance of trucks to the exploration, drilling and production of oil in North Dakota, and that many trucks specially designed for such work are larger and heavier than what present North Dakota laws provide. Thus, most requests for special permits are granted.

Road restrictions. Exceptions to the above weight limitations are placed upon North Dakota roads during a 60-to-90-day period each spring. Because of frost action in highways, the North Dakota Highway Department reduces truck weights. Lower load

It takes rugged, dependable truck winches to move today's portable draw works, power units and masts. You are always sure and safe when your trucks are equipped with BRADEN WINCHES. They are made in capacities from 3,000 to 100,000 pounds.

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January 31, 1955

Mr. W. L. Childs, Jr.
General Sales Manager
Reed Roller Bit Company
Houston 1, Texas

Dear Mr. Childs:

I thought you might be interested in the exceptional performance records of your Reed Super Shrink-Grip Tool Joints.

We drilled more than fifty miles of hole...with no failures...with Reed Super Shrink-Grip Tool Joints.

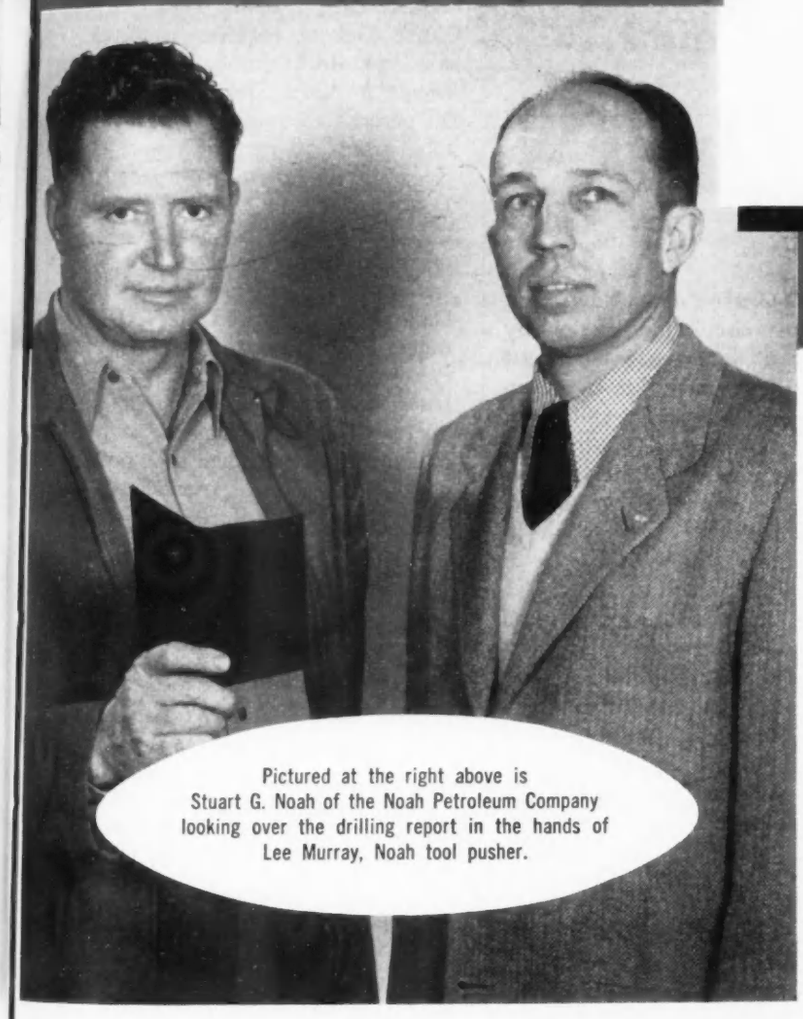
We drilled 102 holes for a total of 266,420 feet with two strings of 4 1/2" 16.60 lb. drill pipe each with two strings of Reed 4 1/2" X 6" O.D. API Full Hole Super Shrink-Grip Tool Joints.

We had no fishing jobs or other tool joint trouble of any kind. All of this drilling has been in the Illinois Basin where the formations are very abrasive and the average life of 4 1/2" drill pipe is about 100,000 feet, with the life of the tool joints averaging 50,000 feet.

The above information on Reed Tool Joints is typical. That's why we have been a long-time 100% Reed Tool Joint user.

Stuart G. Noah

SGN:a



Pictured at the right above is Stuart G. Noah of the Noah Petroleum Company looking over the drilling report in the hands of Lee Murray, Noah tool pusher.

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limits are determined after extensive sub-grade tests conducted by the department. It is claimed such tests indicate the reduced carrying capacity of roads, and axle weights are reduced accordingly.

During the spring of 1954, single axle loads were reduced to low of 10,000 pounds and a high of 14,000 pounds per axle. Tandems varied from 16,000 pounds to 24,000 pounds per set of tandems. (These limits included a special 1000 pound tolerance per axle granted during the 1954 road restriction period.)

About 75 percent of North Dakota's roads and highways are restricted each spring. The highway department has available on request, a list of all roads restricted in the state. This can be obtained at Bismarck or at any of the highway department division offices.

Out-of-state trucks. North Dakota law provides that all vehicles no matter where they come from must comply with North Dakota size and weight limitations. In no case, for example, will North Dakota permit a 60 foot truck with 78,000 pounds gross from Montana to operate over its roads.

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Reciprocity. Reciprocity privileges are extended by North Dakota to eight states and one province of Canada. These are Montana, South Dakota, Minnesota, Wisconsin, Illinois, Iowa, Michigan, Washington, and Manitoba. Trucks from the above states may travel interstate in North Dakota without payment of registration fees, truck mile tax or ton fee taxes.

Likewise trucks from North Dakota traveling to the above states are exempt from the license plate and truck mile tax. Vehicles from all the above states, except Montana, are exempt from North Dakota Public Service Commission Certificate and Listing Fees. North Dakota vehicles are subject to the Montana Railroad Commission plate.

Reciprocity between North Dakota and Manitoba is based upon one-half regular registration fees. That is, North Dakota requires each vehicle coming from Manitoba to purchase a license in North Dakota but grants a 50 percent discount. Likewise Manitoba grants 50 percent reduction on truck license plates sold to North Dakota units.

In the case of truck fleets, operators must prorate license according to percentage of miles operated in North Dakota as compared to total fleet miles. In other words, if a truck operator from Minnesota operates six trucks and one-half of its miles are operated in North Dakota, and one-half in Minnesota, then such operator will license three trucks in North Dakota and three in Minnesota.

Vehicles from all other states and provinces have choice of purchasing North Dakota license plate or paying truck-mile tax. The license plate is valid during year of purchase and can be purchased for any remaining portion of a year. The truck-mile tax applies to each trip made through the state and must be paid upon entering.

Those vehicles purchasing North Dakota truck license plates are also subject to another plate fee called the "ton fee tax."

Truck license. Truck registration fees are based upon the gross weight of the vehicle or combination of vehicles and applies to the power unit only. A trailer plate is available at cost of $1 but is not required.

Truck license fees are on a graduated scale, a higher rate for every 2000 pounds gross weight. There is

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also slight reduction for older vehicles. License fees vary from $50 on new truck in 18,000 gross class to $950 for new truck 60,000 pounds or over.

All license plates are due January 1 each year, with penalty applying February 1.

New vehicles or trucks brought into North Dakota for the first time may obtain plates for less than one year. A one-twelfth discount is permitted for each month preceding date of application for plate.

Ton fee plates. Ton fee plates are based upon $3 per ton for vehicles grossing from 12,000 to 24,000 pounds and $5 per ton for vehicles with gross in excess of 24,000 pounds. Thus a 20,000-pound gross unit will pay $30 for the ton fee plate. A 60,000-pound gross truck will pay $150. This is in addition to the regular truck license plate and applies to all trucks purchasing license plates, except to trucks operating between farm and local trading place, between farms, or within a city or village.

Truck mile tax. The truck mile tax applies to all trucks coming from state or province not having reciprocity with North Dakota and which do not purchase North Dakota license plate. Truck mile tax rates are based upon the unloaded weight of the truck or combination. They are as follows: Vehicle or combination of vehicles having an unloaded weight of not to exceed 3 tons, 1 cent per mile; not to exceed 4 tons, 2 cents per mile; not over 5 tons, 3 cents per mile; not over 6 tons, 4 cents per mile; not over 7 tons, 5 cents per mile; not over 8 tons, 6 cents per mile; and those with unloaded weight of 8 tons and over, 7 cents per mile.

The PSC. Rules and regulations of the Public Service Commission govern the operation of trucks operating in intrastate commerce when engaged in for-hire or contract service. The Commission has no jurisdiction over private carriers. It classifies trucking into four categories; Class "A" Operators; Special Operators; Contract Operators and Interstate Operators. All but the latter are required to obtain a Certificate of Public Convenience and Necessity from the PSC at Bismarck to operate in North Dakota.

To obtain Certificate or Permit from the North Dakota Public Service Commission, an application (furnished by the PSC) must be filed together with filing fee. Class "A" applications are $50; Special Operations, $40; and Contract Permit applications $15. Operators engaged in interstate commerce exclusively, are required to file name of resident agent for service of notice and process.

Upon receipt of application from either of the first three types of truck operations named above, the commission will set the matter for public hearing at which applicant must prove convenience and necessity, show proof of insurance, and that it is physically and financially able to perform the service.

The PSC further requires that each vehicle to be operated in North Dakota under Class "A" authority, Special Authority/or Contract Permit, must be listed with the Commission. A fee of $15 is made for each truck so listed. A "C" plate is then issued to each of such units for which an additional fee of $15 is assessed each unit. It therefore costs a total of $30 for each truck listed with the PSC, with maximum of $150 for fleet. This equipment listing is required annually.

The Public Service Commission also prescribes rules for filing of rates and charges, safety regulations, required records to be kept, public liability and property damage and cargo insurance.

In addition to the above fees required by trucks, North Dakota has a 5 cents per gallon gasoline tax and a 5 cents per gallon diesel fuel tax. The latter tax also applying to all fuels other than gasoline when used upon the highway or in highway construction.

As can be seen, there are many regulations governing the operation of trucks in the state. All are probably very necessary, but the scope of some are often questioned. It is a sincere hope of the truck industry, for example, that the present over-all length law be increased to 50 feet. This will help in the movement of many oil field supplies and equipment that cannot be transported within present length limitations. It is also hoped that reciprocity with many other states, including such oil states as Texas, Oklahoma, and California will be reestablished. The high truck-mile tax in North Dakota has created a trade barrier between it and all but eight states in America.—**The End**

Continued from Page 119

that all buildings, tanks, etc., could be unloaded at their permanent location, thereby eliminating double handling. The best and most commonly used building arrangement is to set all buildings and tanks behind the rig with the front facing towards the driller's side of the rig. The position of the individual buildings is not important except that the boiler house and water tanks should be last in line, so that the lines can be run along in front of the buildings making the steam and water more accessable.

After the substructure is together, the drawworks up, the derrick pinned, and the pumps set, there is no further need for the big trucks. They should be released. The drill pipe should always be the last thing to be moved. With three sets of pipe racks, all of the double handling can be eliminated and the drill pipe will not have to be handled with a gin truck. Many contractors will not allow a winch line to be put around their drill pipe due to the damaging effect on the pipe.

Accessories which are needed on the floor should be placed around the rig so they can be easily picked up with the cat-lines.

Not enough trucks or trucks that are too small is false economy. It is cheaper to have an idle truck than to have a good crew of men waiting on something to arrive which they need to rig up.

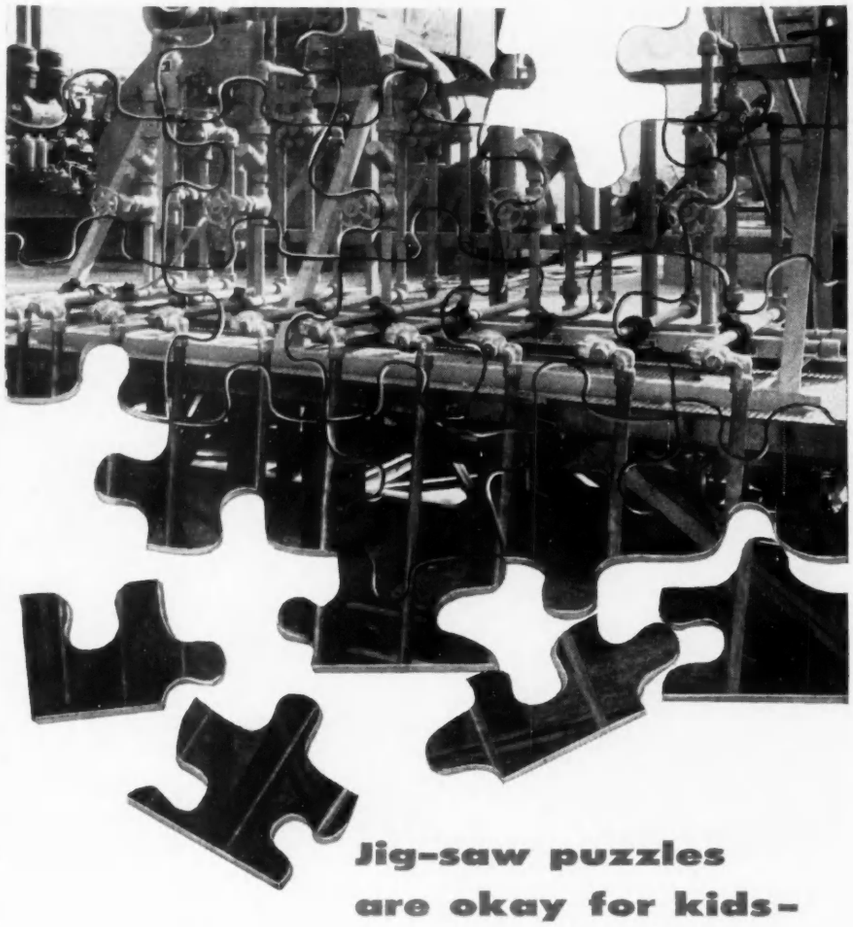
It is also impossible for a trucking contractor to move a rig efficiently by himself. He must have good cooperation from rig crews.

The secret of getting good rig moves is organization and cooperation. A pusher must call the trucks when he needs them and in the order he needs them, and not before. He must make sure that the truckers do not just drop things anwyhere at the new location. In this respect, truck drivers that are familiar with equipment are a big asset. He must watch and release the trucks when they are no longer needed, and last, but not least, he must have full cooperation from everyone, especially his crews.

A good thing to keep in mind is that a well organized and good move is a safe move.

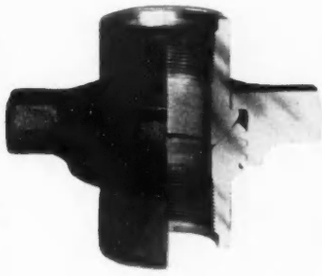
ACKNOWLEDGMENT

Based on a paper presented at the Fourth Annual Oil Well Drilling Safety Clinic, Banff, Canada, sponsored by the Canadian Association of Oilwell Drilling Contractors.



Jig-saw puzzles are okay for kids—

but not for a rig hook-up!



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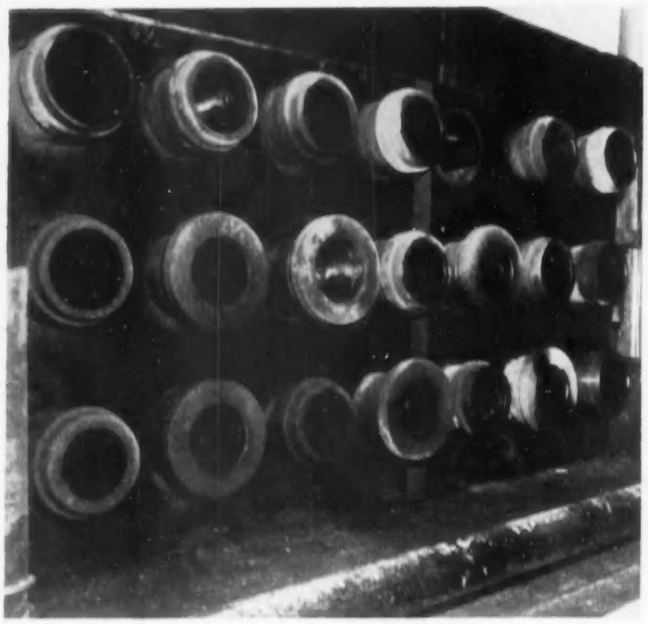

Rack and Hoist Speed Liner Handling

Installation of a multi-size rack and an overhead traveling crane will expedite liner handling, permit rapid supply inventory, reduce possible liner damage and corrosion and assure proper facilities for safe handling.

The installation can be made in a tool house, generator or general utility building, the only limiting factors being available space and proper ceiling strength.

The liner rack can be fabricated from steel plate and casing nipples or two sections of steel plate with split casing, bar stock or angle iron serving as combination guide shoes and dividers. The illustrated rack follows the structural detail of steel plate and split casing sections which rack the liners and separate the two plate steel panels.

Rack diameters need not vary as long as the size will accommodate the largest liner required by pumps on location.

Another feature which can be incorporated is angle placement of the split casing guide shoes to insure that liners will remain in place. Although this design involves greater expense, advantages from the standpoint of safety and handling make it well worthwhile.

Use of heavy gage steel plate and split casing guides will eliminate need for elaborate internal bracing. Furthermore, the rack can be anchored to the tool house floor for greater over-all stability.

This installation alone will pay dividends to the operator interested in proper equipment maintenance plus a plan for rapid parts handling. However, with the installation of a light gage overhead "I" beam, of a dimension suitable for a lightweight trolley and hoist assembly, final refinements will be incorporated in this complete liner handling set-up.

The location-fabricated hoist track can be anchored to the cross supports of the building roof by means of 2-inch pipe nipples. Or, depending upon the height of the building, it may be possible to weld the "I" beam track directly to the building roof support.

Installation of this rig in either a generator or general utility building will serve a two-fold purpose by the fact that not only liners but all equipment operating or stored in the building can be lifted and moved by means of the trolley-type hoist.

Pump liners or other equipment stored in the building rigged with the overhead hoist can be moved with manually propelled trucks, or casing wagons from the utility or tool house to the area where needed.

An inexpensive installation, the above plan will aid in making the tool or utility house a more efficient storage unit. By greatly reducing the possibility of damage to just a few liners, the unit will soon pay-out.

Welded Loop Eases Stairway Handling

Two sucker rod loops, welded at a near balance point on either side of rig stairways, will permit easier handling with either the rig cat line or a truck winch line over high gin poles.

In those areas where rigs are skidded from location to location, the loops permit lifting the stairway to the derrick floor with comparative ease.

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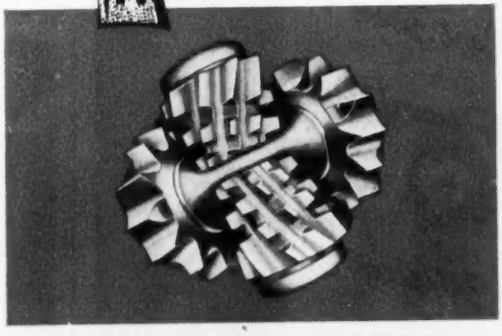

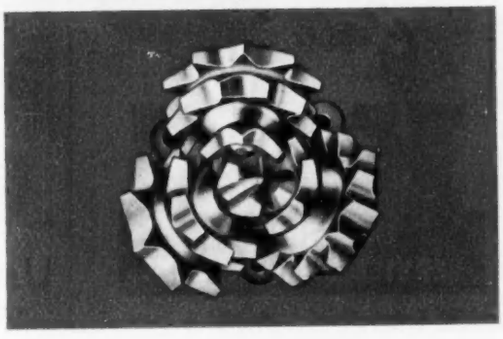

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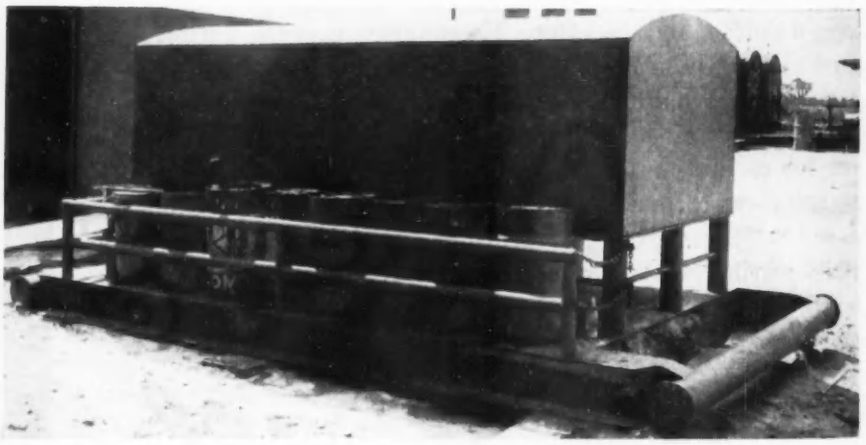
Tank Skid Serves as Ladder

Rod rungs welded in the recess of an "I" beam skid member provide a tank ladder which is protected from rig move damage. This simple installation also eliminates need for carrying makeshift, and often hazardous ladders, with the rig.

The tank skid unit shown is fabricated from 8-inch and 10-inch "I" beams. The smaller beam is welded to the tank side. Bar stock chalks, approximately 18 inches long, are welded to the 8-inch beam and tank to compensate for tank curvature.

The 10-inch "I" beam is welded atop the 8-inch beam as the skid base. Four-inch tubing reinforcing spreaders are stationed at the skid base and top.

Installation of the ladder rungs simply involves cutting sucker or reinforcing rods to proper length and welding them within the "I" beam recess. The distance from one rung to another is gaged for both safety and convenience. The rungs should be located far enough away from the flat surface of the "I" beam to allow secure footing for personnel using the ladder.



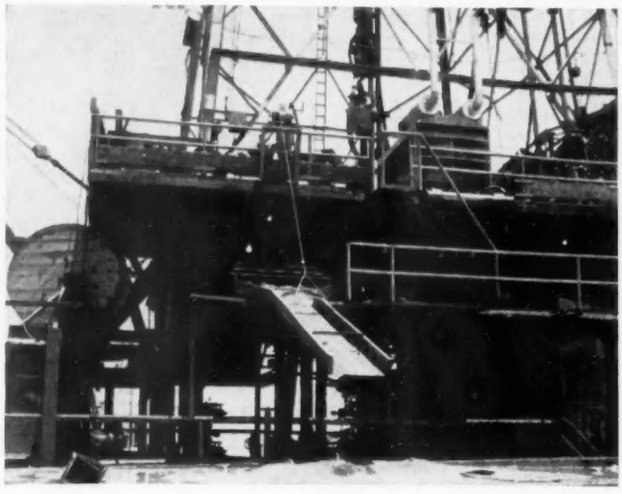
Use Utility House Skid for Drum Storage

The problem of grease and dope drum storage can be solved by increasing the width of a utility, generator or tool house skid.

Simple in design, this idea can be adopted in the construction of new units; or, in the case of older units with narrow skids, the same plan can be incorporated by connecting "I" beam extensions to the skid frame.

Guard rails are attached so that it becomes unnecessary to remove the drums when the rig is transported.

Equip Rig With Chute, Spool Support



Adaptable to barge or land locations where the shale shaker is nested within the substructure, the adjustable shale shaker chute makes it possible to exercise better control over dumping speeds and pit distribution.

When fast drilling formations are penetrated, the permanent shale shaker chute will often become clogged with cuttings. Furthermore, the non-adjusting chute does not permit quantity accumulation of pit cuttings. Unless the cuttings are frequently moved from the mouth of the chute, stoppage will occur. The extension chute will route cuttings to a refuge barge parked alongside a marine rig.

The above shale shaker chute is made of heavy gage metal shaped and welded into the desired pattern. An apron extends approximately one foot behind the shaker dump so that with multi-level chute elevations, no spillage will occur. Pin hinges connect the chute to the side of the shaker bed.

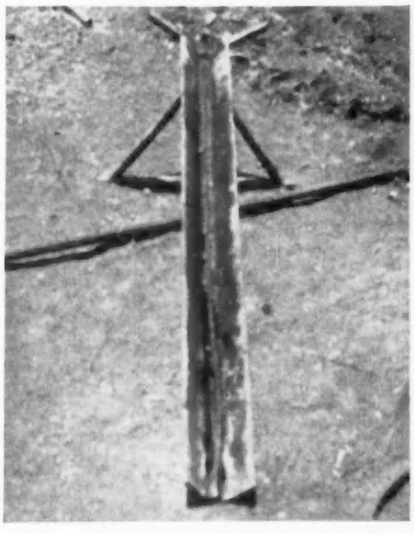
Reinforcing is welded across the top of the trough for rigid reinforcement. The number of cross members installed will depend upon length of the chute.

One-half inch cable connects the hinged chute to a hand operated hoist on the derrick floor. Due to the light weight of the over-all unit, 2-inch angle iron can be used for the elevated winch base.

Also featured on the above rig is the outboard wire line spool support seen at the far left. The installation consists of bridging the open area between the substructure and an extension on the pipe rack walk support with two sections of 6-inch "I" beam. On drilling barges, the installation remains permanent.

An altered version of the same plan can be incorporated on a land rig by extending two horizontal base beams from the derrick substructure and angle supporting the base beams with sections of drill pipe welded to both the beam and the substructure or derrick legs. The installation can be made with little difficulty on land stationed rigs; particularly in those areas where skidding rather than tear-down is practiced.

In either case, the installation permanently locates the surplus line spool and eliminates concern about line accumulating damaging abrasives by dragging across the ground or barge deck.



Rack Made From Scrap Expedites Core Handling

A four or six-foot section of derrick bracing, or a comparable length of 2-inch angle iron with welded 2-foot rod supports on the blanked end, will facilitate washing, sorting or inspecting rotary cores.

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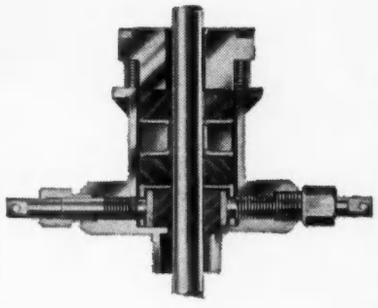

The #176 receives lubrication directly from the pumping well and greatly increases the safety and efficiency of oil field service. It eliminates trouble caused by neglect and carelessness and has a shut-off which enables the operator to shut off the well while repacking the box. The Ratigan 176 Stuffing Box is made of high grade electric steel and is tested to 3000 lbs. Inner bronze eliminate any possibility of scoring the polished rod.

Self lubricating Stuffing Box gets oil directly from pumping well. Polished Rod is self aligning within the box.

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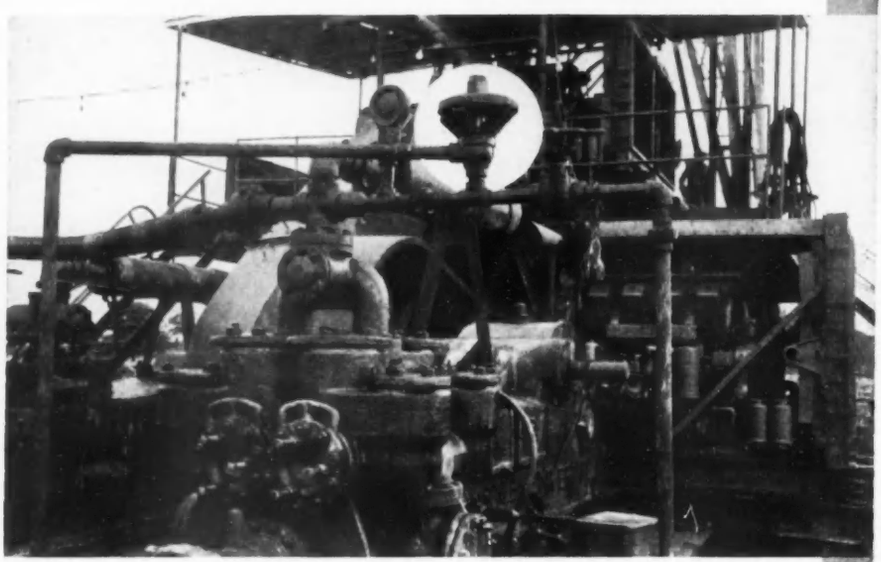

Danger to personnel, damage to hole and equipment are ever-present hazards of excessive pressures. In each case the danger is cut to a minimum when you install Kinzbach Model 112 Relief Valves. They open automatically and instantly when the line pressure goes beyond safe limits—and when the pressure drops to a predetermined level, they close automatically.

The 112 is easily set to open at any overload pressure and the setting is exact. There's no guesswork whether it is too high or too low. When the line pressure goes beyond this pre-set limit, the valve opens automatically and instantly. When the line pressure is reduced, the valve automatically closes. If desired, a warning horn may be attached to signal while overload pressure is in the line.

The fast and automatic action of the Model 112 Valve protects personnel from bursting hoses, couplings, and valves caused by runaway pressures; and protects equipment from overload damage. It also greatly reduces the possibility of hole damage by allowing the driller to keep pressure in the circulating system during a momentary block, such as might occur from spudding into bottom.

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Compartment Screens Oil From Excess Water, Mud

When the fluid ends of mud pumps are lubricated with a thin oil instead of water, the lubricant should be kept free of any water and/or mud that may leak through the packing glands of the pump.

One contractor builds a screen compartment inside the sump box into which the lubricant drains from the pump rods. The lubricant runs through a 2-inch pipe and through the screen. The water is siphoned off through the water leg made of ¾-inch pipe. The lubricant is picked up inside the compartment at a point well above the water level and clean oil is pumped back to the piston rods. Every 24 hours the entire sump is drained and cleaned so that no mud and water can collect and be pumped back to the rods.

Install Removable Catch-all To Collect Doghouse Refuse

A good housekeeping practice that saves much time and effort on the part of clean-up crews around the drilling rig consists of mounting a screened-in container for collection of used paper towels, paper cups, lunch wrappers and similar combustible rubbish on the outside of the doghouse.

Illustrated in the photograph, the expanded metal-covered container is hung on the outside of the doghouse opposite a small hinged trap door which has been cut out at a point near the wash basin inside. The container has a pair of hooks on the upper inside corners which hook into

Wire Rope at Work—The intrepid derrickman whizzing through space in the picture above was photographed while demonstrating the safety slide. This device makes possible rapid escape from the mast in case of a blowout or other hazard. The rig shown here, which is owned by the J. W. McCutchen Drilling Company, Wichita Falls, was working at the time in Coke County, Texas.

The safety line consisted of Bethlehem 6x7 wire rope with a bethanized coating to guard against corrosion. Less spectacular in its application, but with far heavier duties, was the 6 x 19 Bethlehem rotary line, which of course saw active service hour after hour, day after day. Though installed for widely different purposes, both ropes were chosen for their known ability to do the work assigned to them, and do it well.

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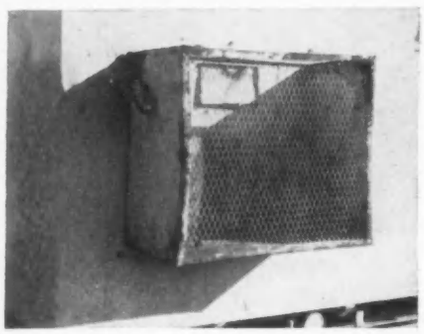
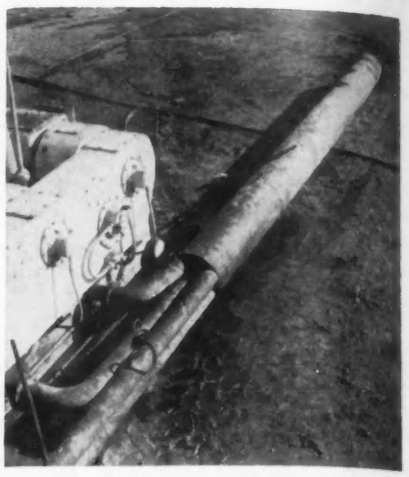


ears welded to the side of the dog-house. Handles welded to the side of the container are sloped at a 45 degree angle to facilitate handling.

Use Large Diameter Pipe As Muffler for Engines

A lowering of noise level around the rig plus a simultaneous reduction of fire hazard from occasional engine exhaust sparks can be accomplished at one time by grouping several exhaust lines inside a long section of large diameter henskin pipe. Grouped as shown, the four engine exhaust lines need not be of a critical length and no welding or flanging is necessary to rig the muffler once the engine exhausts are installed.

The pipe, being open at both ends, creates the effect of allowing cool air to be drawn in along the hot exhaust lines, thus further lowering the temperature of exhaust gases before they are expelled at the far end, some 20 feet from the rig. The pipe, being of light gage steel, easily is withdrawn and re-installed at the next location.



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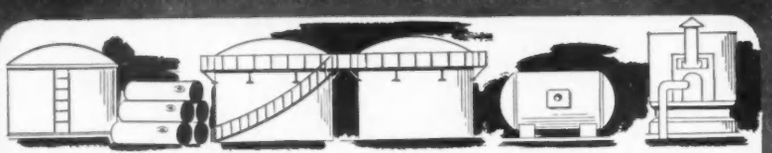

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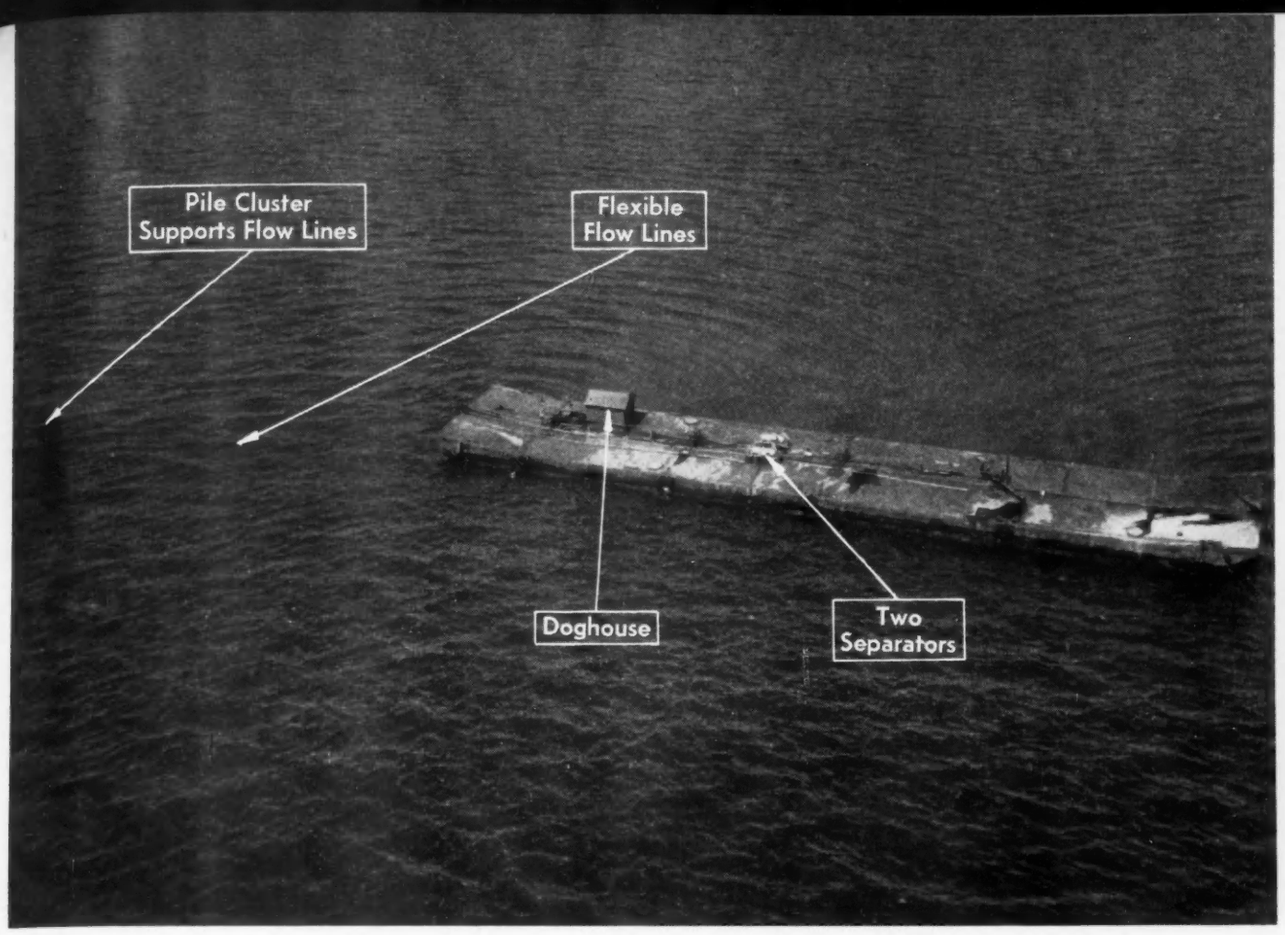
Construct Rod Ladder To Aid Tank Servicing

Inspecting, filling or entering a drilling location fuel or water storage vessel will be more convenient with the installation of a simple, sucker rod fabricated ladder, as shown in the above illustration.

The ladder rungs are all approximately 18 inches long with two 90 degree turns on each end.

After each rung is welded to the tank side, single sucker rod supports are cut and welded to both the ladder rung and the side of the tank. While the lower rung is reinforced with three rods to reduce damage from transport handling, the remaining rungs are supported with just one centrally-located rod.



Oil storage barge anchored in the Breton Sound Block 20 field. Pile cluster at left supports flow lines. Flexible flow lines float between the piling and the barge. Two separators and a doghouse are mounted on the barge.

How to Cut Offshore Producing Costs

Kerr-McGee did it by using caissons for protection of producing wells and anchoring floating storage barges in place of platform structures.

By GRIER D. ZIMMERMAN,
Kerr-McGee Oil Industries, Inc., Morgan City, La.

MUCH HAS BEEN said and written about the excessive cost of drilling in the search for offshore oil. Nearly everyone realizes that the drilling costs are high when compared with the drilling costs on land, and the fact is vividly brought out since payment is generally made in a lump sum.

Much less attention has been given to offshore producing costs. These costs, when looking at the over-all economics of an oil field, represent a much larger sum than the expenditures necessary to drill and equip the wells, onshore or offshore. There is a tendency to overlook this fact since producing expenses are spread over many years and usually are paid out of current income.

In view of these facts, the major portion of savings to be made and profits to be had in the offshore oil province will be made through the efforts of production personnel in simplifying, unitizing and otherwise reducing costs of operations. These efforts will represent more profit dollars over-all than the now active campaign to design equipment for lower

A conventional heavy-duty tug and oil transport barge are used by Kerr-McGee to move production from field storage to the purchaser's terminal.

cost drilling. In many cases, operating methods will mean the difference between profit and loss.

Block 32, Block 20 and Block 21 fields in Breton Sound, Plaquemines Parish, Louisiana, were developed by Kerr-McGee Oil Industries and Phillips Petroleum Company with Kerr-McGee acting as operator for the joint owners.

The discovery wells and development wells were all drilled with the company-owned submersible, barge-mounted rig. Water depths in Breton Sound are in the 18 to 25 foot range, and 22 feet of water is the approximate top limit for the particular barge rig used in these fields without shell fill or other additional base material. Because seismic devices were not conclusive for mapping subsurface in this area, the barge rig was also used in a unique exploratory program to drill 3000-foot strat-holes.

There are no piling platforms used in these fields. Protective steel caissons 7½ feet in diameter and some 45 feet long were pulled down around the wells with the drill barge, leaving about 15 feet of each caisson above water level.

In wildcatting the caisson usually was not put in place until it was determined that the well would be productive. These caissons served as a guide while the rig was being moved away and, thereafter, as protective platforms for the producing wells. An expanded metal decking was placed over the top of the caissons around the wellheads and circular hand rails welded around the edge of the caissons for easy and safe access to the trees. Bits were welded on these structures so that work boats could tie up. Ladders were provided to aid personnel transfer from boat to well. A steel battery box containing wet cell batteries to power the warning light and fog horn was mounted on each caisson.

In these fields casing is set through the productive sand and the wells completed through perforations. Tubing is run through permanent type packers which are placed and set with a wire line. Trees are a standard double master gate, double flow wing type.

Since these reservoirs amount to thin oil columns trapped above water in relatively massive sand bodies, 100-150 feet thick and continuous over large areas, it is expected that they will be depleted completely by natural flow.

On this assumption, routine completion is to perforate the casing from a gamma ray log, set the packer on the same wire line, run and space the tubing, install the tree on the tubing, displace the mud from the tubing with water, set the tree down and secure it to the tubing head then bring the well in flowing on a choke.

An oil barge, equipped with testing facilities is tied along side the drill barge to test well performance. When rough seas prohibit tying the two barges together, the oil barge is allowed to hang off on a bridal, and flexible rubber hose is used to connect the tree to the test equipment.

There have been instances where the electric log was conclusive enough to insure production from field wells and the flowline was laid prior to completion, allowing testing through the normal producing facilities.

After testing, the well is shut in, the annulus between the caisson and casing filled with pea-gravel, the decking and handrails put in place and the rig moved.

Since piling platform structures large enough to contain storage tanks and separating equipment were and are expensive per square foot of deck space, 8500-barrel capacity floating barges with adequate separation

equipment have been anchored in these fields in place of the tank battery.

Early use of this system found anchorage of the barges to be the main problem. Heavy Navy-type anchors dragged during the most severe storms allowing the barge to move off location, breaking flowlines and creating a general hazard. This occurrence caused havoc and endangered the lives of the men who worked through rough seas to save wells and equipment.

Use of fixed I-beam piling anchors has eliminated failure of the anchor itself, although anchor lines may still part and turn the barge loose. Four of the fixed anchors, with their tops driven 15 feet below the sea floor, are placed at the corners of a 1500-foot square. A piece of heavy anchor chain approximately 300 feet long connects the anchor and a buoy. These anchors with the attached length of chain are furnished and put in place by an offshore pile driving contractor. A single strand of used 1¼-inch steel drilling line attached to the chain spans the remainder of the distance between the four anchors and the barge placed in the center of the square.

The Geological department was consulted in an effort to place the barge as nearly in the center of the field as possible at the beginning of the development to reduce amount of flow line necessary to connect future wells. The cables are strung, connected to the anchor chain and the barge, and tightened with the company-owned L.C.T. In strong, windy weather, the barges with this anchor system can move 25 feet to 30 feet in any direction, depending upon tightness of the anchor cables.

In a recent storm, when two barges broke anchor lines, an anchor chain was found to have pulled loose from the anchor on one of the lines and the cable had broken on another. The portion of the cable which is alternately exposed to air and sea water and suffers the greatest corrosion had been replaced a few months prior to this storm. The unusual break in the chain may have occurred after a cable parted and allowed the barge to gain momentum, or the chain connection to the anchor may have been damaged when installed. The possibility of doubling the cables for extra strength or using all chain to increase the spring with the added catenary effect is being studied.

Offshore well with 63-foot crew boat standing by. This is a gas well with second protective caisson provided to carry a water knockout. Oil wells have only the single caisson surrounding the well. The tree, caisson, hand rails, and rectangular battery box are easily distingishable.

One or the other of these changes should furnish an anchorage system that will hold the barge on location through quite a severe storm without interrupting production or hazarding loss of a well.

Although some operators feel that the anchored barge method of handling production is poor, or a substitute for something better, it has proved to be adequate and quite successful. Producing costs are found to be considerably less than storage on platforms or other methods proposed for handling oil offshore under these conditions of sea, reserves, and rate of production.

These storage barges are left permanently anchored in the field. A towing contractor transfers the oil to his barge and moves it up the Mississippi River to market at a monthly rate based on the barrelage of storage furnished. Final gaging of the oil is done after transfer into the purchaser's tank battery onshore although proration is done on the basis of individual well flow meters as the oil enters the offshore storage barge.

Oil transfer from barge to barge offshore becomes a problem during rough weather. Although production has not been interrupted from this cause, it has been necessary for tug and tow barge to wait in the area several hours for the seas to calm before they could get alongside the storage barge. They have radio facilities so the crew can check weather conditions with the men in the field before leaving protected waters.

Two and seven-eighths-inch upset tubing is laid uncoated on bottom for flowlines from the wells. These are made up and strung off the deck of a war surplus, self-powered L.C.T. A ½-inch cable is strung from the caisson to a 19-pile wooden cluster or single 30-inch steel piling 75 to 100 feet from one end of the anchored barge. This cable, run through snatch blocks along the side of the L.C.T., guides the L.C.T. as flowline is being laid.

A riser connected to the flow wing of the tree is dropped straight to the ocean floor outside the caisson after a joint or two of tubing is made up on the bottom end. To hold this in place at the base of the caisson, a chain is wrapped around both the caisson and the riser, then dropped to bottom. All this is done off the lowered bow ramp of the L.C.T. as it faces the well and off the caisson itself.

With the riser held in place at the bottom by the chain, additional joints

of tubing are made up from the tubing supply on deck of the L.C.T. As each one is made up by the crew, the operator backs the vessel away, the cable doing his guiding, allowing the line to string out over the ramp. This line can be laid almost as fast as picking up tubing and running it into a well.

As the line laying progresses from the caisson and reaches the piling cluster near the barge, a crash boat carries the stern anchor of the L.C.T. out in the direction of the wind and drops it. The guide cable is released and the L.C.T. maneuvers by tying to the piling and pulling on the anchor line. As the last bit of line is laid, the ramp, approximately at water level, is brought alongside the piling where the flowline is cut and a riser installed. The flowline, coming directly up, is secured to the stationary piling. A high pressure, flexible, rubber hose spans the 75 to 100 feet from the piling to the floating barge. Sufficient hose is supplied to allow for normal movement of the barge.

Separation of gas and oil is done through separation equipment equipped with both an oil and gas meter. In the Block 32 field, there is a considerable amount of salt water production. An emulsion breaker is added to the production and the water-oil emulsion is allowed to separate in the storage barge. As the salt water accumulates in the bottom of the compartments, it is picked up with a gas-driven steam pump and discharged overboard. Obviously there is no salt water disposal problem.

Paraffin accumulates in the top 1500 feet of the tubing at a fairly high rate. Cutting paraffin offshore on the small caisson platforms and with a small boat becomes quite a problem. A gin pole made of 2½-inch tubing is placed permanently on each wellhead to hoist the lubricator into place. The wire line unit is mounted on the stern of the 85-foot crew boat and the boat is allowed to hang on a line 40 to 50 feet off the lee side of the caisson during the paraffin cutting operation.

If the sea is rough, this operation is difficult and sometimes impossible with such a small boat. At times it has been necessary to bring in an L.C.T. when bad weather has delayed cutting and the paraffin has become so firm in the tubing that it is necessary to spud the cutting tool. Deck room on the L.C.T. allows space to work the wire line for this spudding and the larger size and heavier weight permits working during rougher seas. At present, consideration is being given to installing an individual set of scraping tools at each well.

In general, very little lost productive time has been experienced in this operation and the costs have been relatively low. Producing costs are approaching those experienced with onshore operations of comparable size. Two men per tour handle the operation of these oil fields with the aid of one 85-foot boat and its crew of two men. These men alternate, working offshore a week and spending a week onshore. During the week onshore, they spend three working days maintaining and operating the base station at Gulfport and attending to the sale of oil at New Orleans as the oil is transferred from the barges to the purchaser's shore battery.

In addition to gaging the barges and checking the wells each day, they handle paraffin cutting maintenance of the separating equipment, painting, and general maintenance of facilities. At times of rough weather or fog, many hours are consumed in performing these duties. Sometimes in the foggy season, wells can be found at night better than in day light. These men, aided by the L.C.T. crew, laid most of the flowlines, anchored the barges, and connected the wells during the development period.

A very minimum of contract labor and extra boats has been used in either the development or operating phases. The L.C.T. which has a wide variety of uses is employed only for special jobs on a day-to-day basis. Prior to the recent installation of living quarters on the island in the nearby gas field, the operating personnel lived aboard the 85-foot work boat. At night, they tied up to a barge or a well.

Short wave radio and radio telephone communication facilities aboard the boat enables operating personnel to contact the island, the shore base at Gulfport, Miss., or the division office at Morgan City, La. The oil towing contractor is contacted by radio or telephone when sufficient oil is in the storage to make up a tow.

Further study, research, and experimenting may prove that producing methods similar to those used in this field will be profitably applicable in deeper and less protected waters farther out in the Gulf of Mexico

Some operators are now using platform and sunken vessel storage and some are moving the oil directly to the refinery by oil tanker. Since factors such as depth of water, distance offshore, prevailing weather, size of reserves, and rate of production enter into the determination of the best producing and oil handling method, each new field will necessarily need to be treated individually as it is discovered. Much more study and experience is needed in this important economic phase of the large offshore oil development program.

ACKNOWLEDGMENT

The cooperation of the management of Kerr-McGee Oil Industries, Inc., in permitting the preparation of this paper and in releasing the information contained herein is grateful acknowledged.

—The End

About the Author

GRIER D. ZIMMERMAN graduated from the University of Oklahoma in 1949 with a B.S. degree in Engineering Physics and the same year started his career in the oil business with Seismic Engineering Company, Dallas, Texas. He joined Kerr-McGee Oil Industries, Inc., in 1950 and has had a varied experience, having worked in the Panhandle oil and gas fields, the Permian Basin and the Mid-Continent area of Oklahoma. He has had experience in both land and offshore operations in the Louisiana Gulf Coast and is presently in Kermac's drilling department at Morgan City, La., as drilling supervisor of an offshore submersible drilling device.

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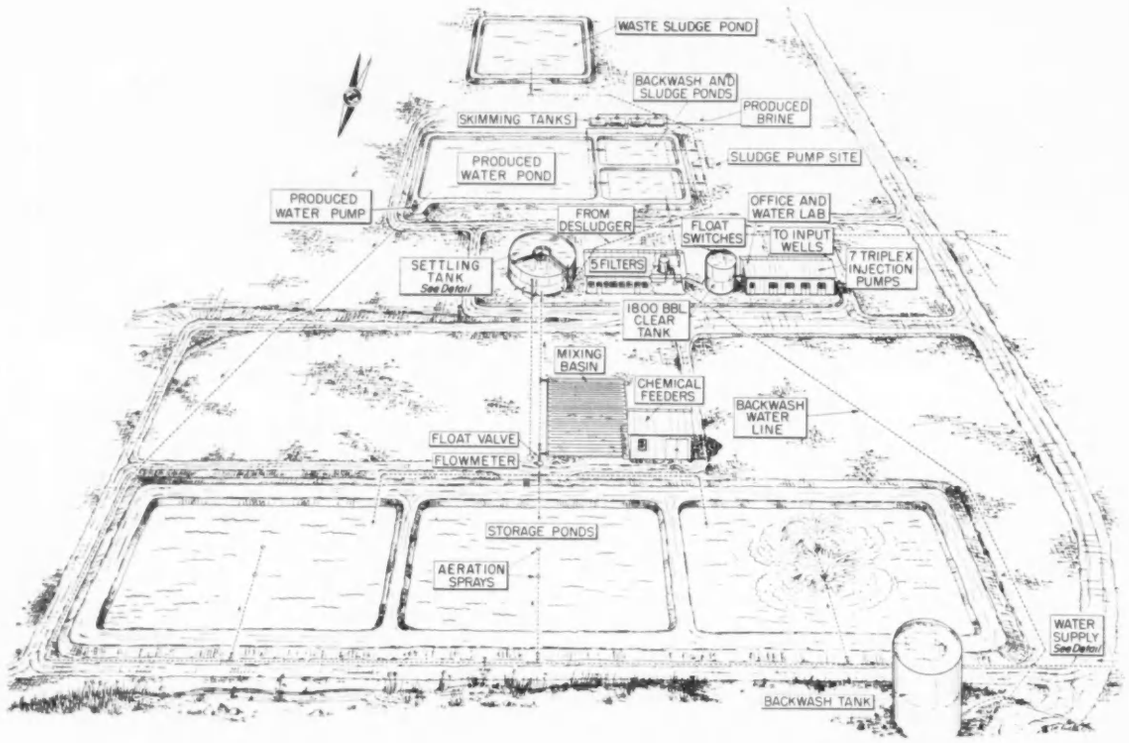


Water-treating plant of Sinclair Oil and Gas Company, Tanner flood, Nowata County, Oklahoma.

Sinclair's Tanner Flood Embodies Unique Features

- Automatic controls
- Field laboratory
- Gravity flow
- Gravity filtration

By ANTHONY GIBBON,
World Oil Staff

Sinclair Oil and Gas Company's Tanner water-flood project in Nowata County, Okla., is characterized by a number of unusual operational features designed for greater efficiency and economy. They include complete gravity flow from storage ponds to injection pumps, water filtration by gravity with rated throughput of 50,000 barrels daily, automatic controls, and a modernly equipped field laboratory for making water analyses on the job.

The Tanner project is the eastern extension of the larger Sinclair-operated Delaware-Childers water-flood. Water injection was started on this block March 1, 1954. In February, 1955, the average water injection rate was 47,506 barrels daily. Daily oil production from 1195 acres was 1300 barrels. More than 270,000 barrels of oil were recovered during 1954.

Original development on the leases included in the Tanner water-flood project began in 1907 and was virtually completed in 1910. During 1909 the annual oil production reached a peak of 2.1 million barrels, but by 1924 it had declined to 91,000 barrels. Gas and air injection was started in 1925 and by 1936 the leases were producing 546,000 barrels of oil annually. The production rate thereafter decreased gradually to about 148,000 barrels in 1953 when water injection first increased the rate of production. As a result of air-drive between 1925 and 1954 an estimated 6.89 million barrels of oil was produced in addition to 8.64 million barrels that would have been produced by primary-production methods and vacuum alone.

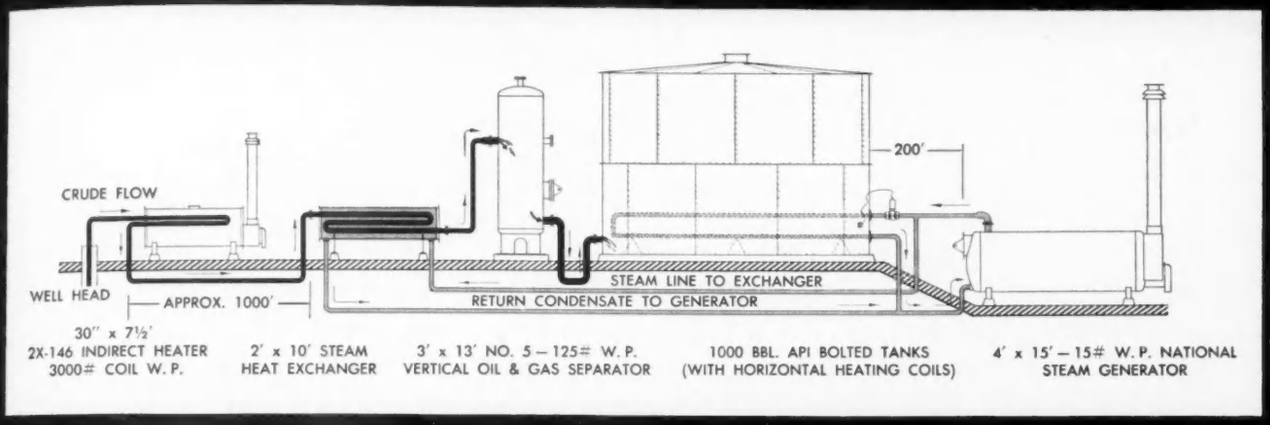
Well Completion and Operating Methods. Although many of the original oil-producing wells are pumped from band-wheel powers driven by 20 to 25-horsepower gas engines, a plugging and redrilling program is in progress. Both 330 and 440-foot spacing is used in completing the five-spot patterns for water-flooding. New oil-producing wells are completed in the same manner as water-input wells.

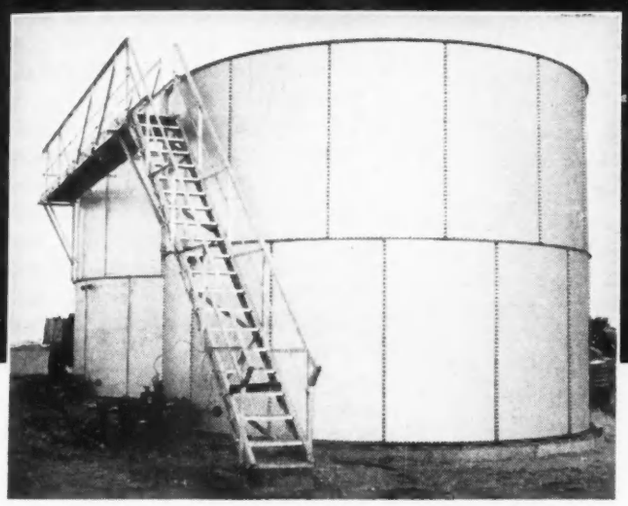
Many of the oil-producing wells are flowing through cement-lined and cement asbestos lead lines that extend to the salt water knockouts and tank batteries. A salt water knockout is used on each lease making an appreciable amount of water. Each tank battery is equipped with an emulsion treater having dump valves which are operated by high-pressure gas. Water in the heaters is kept at 100 F. or above. Brine produced with the oil either flows by gravity or is pumped from the tank batteries by centrifugal pumps through cement asbestos lines to skimming tanks at a central receiving pit at the plant. The skimming tanks remove any oil which bypasses the treaters and prevents oil from collecting on the salt water ponds.

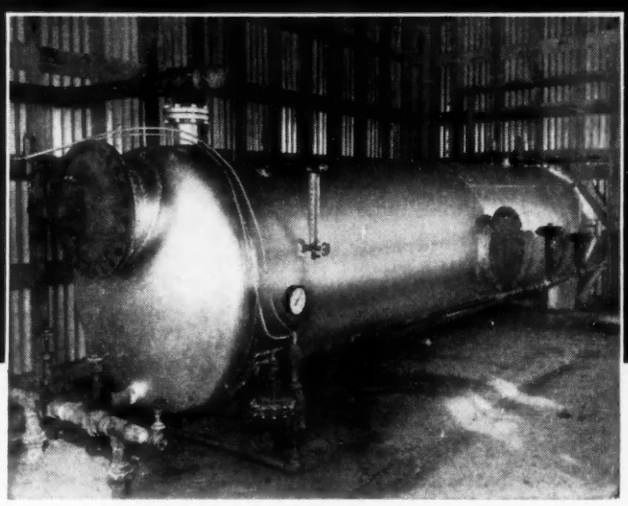
Water-input wells are drilled to the top of the producing (Bartlesville) sand with cable tools. They are cored to the bottom of the sand and shot with one quart of nitroglycerin per foot of oil-saturated sand. The hole

PRODUCTION PROBLEM SOLVED IN UINTAH COUNTY NEAR VERNAL, UTAH

Problem — To handle 240 barrels per day of 37-degree gravity oil with a pour point of 90-degrees.







Solution — National Tank Company equipment is set as per the above flow diagram. An indirect heater is set at each well head for a flow line heater in order to keep production at a high enough temperature to prevent congealing in the lines. Before separation, the production is subjected to an additional heat through a Steam Heat Exchanger so that gas can properly be separated from the oil in the oil and gas separator. Each tank is thermostatically controlled at a temperature of 110° preparatory to being shipped by truck as there is no pipeline connection available at present time. A 4' x 15' two million BTU 15# W. P. National Steam Generator is installed along with coils in each tank to keep the production to 110-degrees in the stock tanks. This is a closed system with the generator set at a lower level than the tank grades and the condensate line buried from the tanks back to the unit. Atmospheric temperatures in this area range sometimes as low as 40° below zero in the winter months.

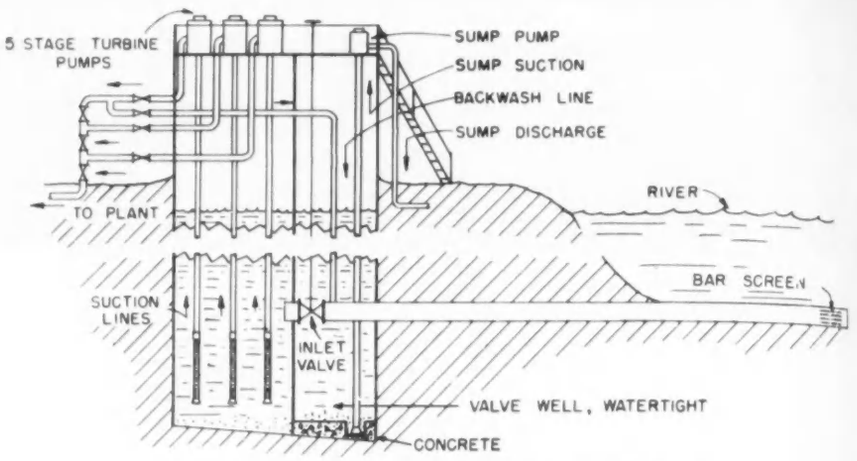
It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

is then cleaned out and deepened to provide a pocket of about 15 feet below the sand. A rag packer set two feet into the oil sand on either 1½- or 2-inch cement lined tubing is cemented in place. A cylindrical cement box provides protection for the well-head connections and water meter.

Source and Treatment of Water. Water for flooding is obtained principally from the Verdigris river and the water supply plant is located approximately 100 feet from the water's edge. River water flows through an 18-inch outside diameter cement-lined steel pipe with bar screen inlet into a large-diameter well. Three five-stage vertical turbine pumps, mounted over a 13-foot diameter caisson set on bed rock at 63 feet, pump the water from the well approximately one mile through 8-inch cement asbestos line to three 40,000-barrel earthen storage ponds on a hillside above the water-treating plant. The turbine pumps are controlled from a central-control panel in the building housing the injection pumps. Water-storage ponds, located at a lower level than the water-treating plant, include two backwash and sludge ponds connected with a larger produced-water pond and a waste sludge pit. Water from the produced-water pond is pumped by a four-stage vertical turbine pump through a 6-inch cement asbestos line that is connected with the river-water supply line at the main storage ponds. The two waters



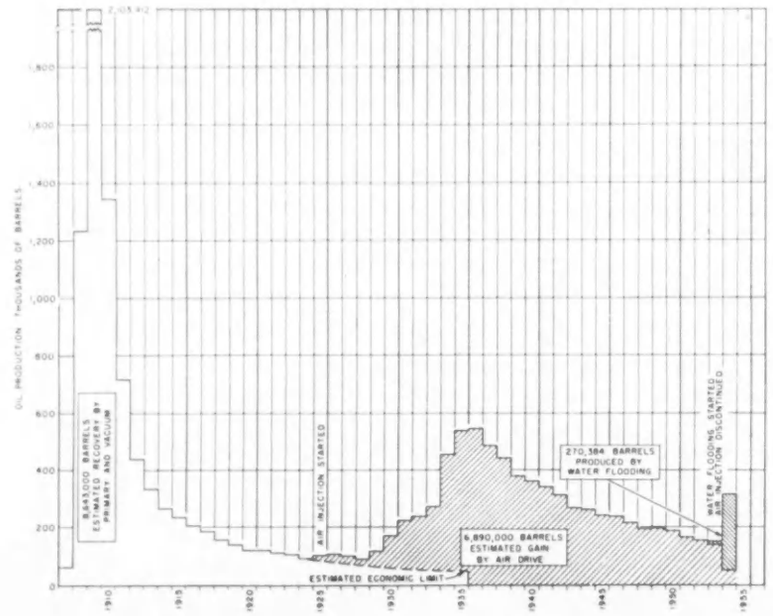
Flow diagram of supply-water station at Verdigris river.

are mixed and aerated by means of a spray in each pond.

As previously mentioned, an outstanding feature in the design of the plant is the use of gravity flow all the way from the storage ponds, through the mixing basin, coagulation tank, filters, clear tank, and to the injection pumps. The only auxiliary pumps required are a small pump to lift clear water to a backwash tank and two sludge pumps to remove solids from the treating basins and ponds.

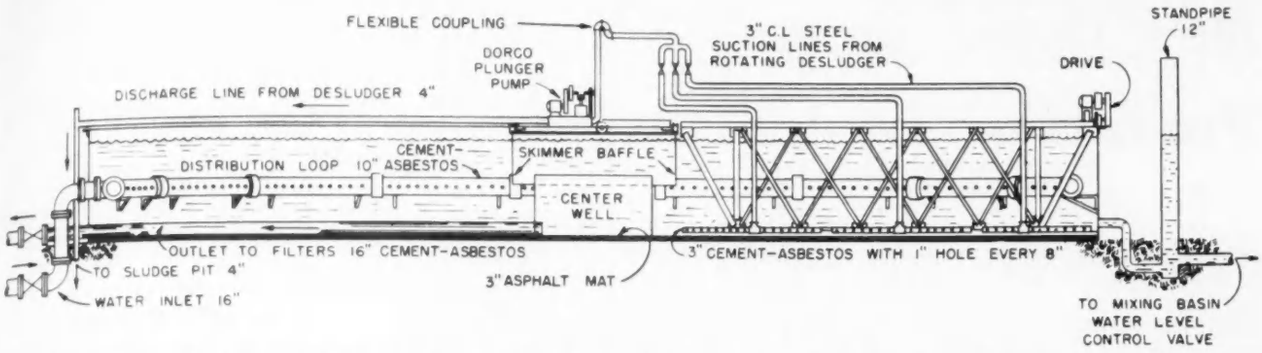
Water flows by gravity from each of the storage ponds through a 16-inch cement asbestos line to a 60′ x 60′ x 5′ masonry mixing basin with closely spaced tile baffles. As the water enters the 2400-foot channel through which it passes in this basin, approximately 1.5 grains per gallon of ferric sulfate and about 3.5 grains of lime are added per gallon of water. The chemical is proportioned by two large hopper-type feeders constructed over a variable-speed conveyor belt. The belt is wide enough to permit the two chemicals to feed onto it without being mixed. The amount of ferric sulfate used is controlled by the speed of the conveyor belt, and the amount of lime is regulated by varying the size of opening on the line hopper. In the ferric sulfate hopper there is a rubber tube from which compressed air escapes slowly that is automatically inflated periodically by a small compressor. This alternate inflation and deflation loosens the chemical that otherwise would pack and clog the hopper opening. The conveyor belt drops each chemical into a separate bowl where it is mixed with circulating water that then flows to a mechanical mixer pot. The two chemicals are both then fed to the mixing basin through 1-inch plastic hoses.

Production history of Sinclair Oil and Gas Company's Tanner flood, Nowata County, Oklahoma.



After flowing through the multi-baffled mixing basin, the water flows through a 16-inch cement asbestos line into a 9-foot-9-inch x 95-foot diameter (12,000-barrel) steel settling tank. The water enters the settling tank approximately midway between the top and bottom and is distributed uniformly around the periphery of the tank by a loop of 10-inch perforated cement asbestos pipe in 13-foot lengths secured to the walls of the tank by suitable supports. The bottom of the tank has been covered with a 3-inch asphalt mat to prevent corrosion.

Sedimentation takes place in the settling tank. The concentrated sludge is sucked from the bottom by a mechanical desludger. It is built on a steel truss attached at one end to a



Sectional view of settling tank with oscillating desludgers at Sinclair Oil and Gas Company's Tanner flood, Nowata County, Oklahoma.

turntable that rotates on a center well in the tank, and the other end is mounted on a ½-hp electrically-driven two-wheel truck that rests on the chime of the tank. The truss extends nearly to the bottom of the tank where it supports three lengths of 3-inch cement asbestos pipe set end to end so that they sweep the entire bottom of the tank when the frame moves around the tank.

The cement asbestos pipe is perforated with 1-inch holes, and each section of pipe is connected by separate suction lines supported truss and through a flexible joint to a plunger pump powered by a 3-hp electric motor. A walkway to the center of the tank prevents the desludger from revolving through a complete circle, so the direction of movement is automatically reversed when it reaches the walkway supports.

The desludger makes a sweep of the tank in two hours, and the automatic time clock controls the suction pump and drive mechanism to provide for a sweep of the tank every 12 hours. Discharge from the plunger pump flows through a 4-inch cement asbestos line to the waste sludge ponds.

Water flows from the main body of the settling tank under a central skimmer baffle and over the 6-foot side of a cylindrical center well where during the hot summer months sufficient crystals of copper sulfate are added for algae control, thence through a 16-inch cement asbestos line that is reduced to 12 inches at the filter building.

The level of water in the settling tank is controlled by a 3-inch cement asbestos line laid to a standpipe at the edge of the mixing basin. A lever attached to the float controls a butterfly-type valve that regulates the flow of water entering the mixing basin.

A small centrifugal pump draws water from the 12-inch line between the coagulation basin and the first filter and forces it through a compressed-gas chlorinator. Approximately 60 pounds of chlorine is added daily. The chlorination room is equipped to handle either standard 220-cubic-feet or 1-ton cylinders. A gas mask is provided for the safety of the workmen. The chlorinated water reenters the 12-inch line downstream from the point of withdrawal.

Water is filtered by gravity through a battery of five open-type sand filters each with a rated throughput of 10,000 barrels daily. The filters are charged with six grades of gravel and sand. They are backwashed twice daily by gravity flow from an 1800-barrel capacity backwash tank located on top of a hill above the supply ponds. The lower portion of the cement asbestos backwash line is 10-inch and the upper portion is 8-inch diameter. The backwash tank is filled by pumping water from the discharge line from the filters into the 10-inch backwash line by a 2 x 1½-inch centrifugal pump powered by a 3-hp electric motor. The one line serves a dual purpose of both filling and drawing water from the backwash tank.

The filter effluent flows through a 12-inch cement asbestos line into an 1800-barrel capacity clear-water tank. The water level in this tank operates four float switches that control the high-pressure pumps through attached mercury switches. Should the water level in the clear-water tank be drawn too low, the combination of switches would shut the pumps down. Water flows by gravity from the clear-water tank into a 12-inch supply header to which suction lines for seven injection pumps are connected. The supply header is provided with a 12-foot open standpipe to assure an adequate supply of water for the more distant pumps.

The seven high-pressure pumps are 4½ x 6-inch triplexes powered by 100-hp induction motors. The pump suction lines are equipped with one-gallon hydraulic accumulators or surge dampeners. The discharge lines are equipped with 0- to 1000-pound pressure gages, 2½-gallon hydraulic accumulators, 650-pound safety valves, and bypass valves. Bypasses from all pumps discharge to a common 2-inch line that returns the water to the bottom of the clear-water tank. The average plant pressure used during the period of formation fill-up is approximately 270 pounds per square inch by the bypass valves set at 300 psi.

The field distribution system is made up of a 6-inch discharge line leaving the pumps and terminating in a 12-inch line. Practically all of the field water-distributing lines are cement-lined steel in sizes ranging from 12-inch for main lines to 1½-inch for lines to individual wells.

Field water analyses are made at the plant in a modernly equipped laboratory. In addition to the usual glassware, the laboratory contains a turbidemiter and a variable speed laboratory mixer. The mixer is used to simulate conditions in the mixing basin and is particularly useful in determining the proper amounts of dry chemicals to be added to the water.

Daily tests are made by the plant engineer for temperature of water, pH value of water by use of the Taylor slide colorimeter, residual chlorine with slide comparator, using orthotolodine indicator, phenolphthalein alkalinity methyl-orange alkalinity, supersaturation, and total iron.

ACKNOWLEDGMENT

Excerpted and revised for WORLD OIL from Bureau of Mines Report of Investigations 5134 "Recent Developments in Water-Flooding in Nowata County, Okla., Oil Fields, 1954-55," by J. L. Eakin.

—The End

New Developments In Production Equipment

As factors affect the economics and efficiency of producing oil . . . engineering seeks to "tailor fit" equipment to the situation. Outstanding developments and trends in oil production equipment during the past year include:

- Dual pumping developments
- Two stage pumps
- Three-tube pumps
- Injection pumps
- Sucker rods
- Pressure control valve
- Ceramics
- Clamps
- Surface production equipment
- V-belt drives

By T. H. FRASER, The Continental Supply Company, Dallas

SIGNIFICANT ADVANCES have been made in the development and application of oil production equipment during the past year. There has been an engineering trend to "tailor fit" the equipment to meet peculiar production problems and patterns, based on thorough consideration of the many factors which affect the economics and efficiency of producing oil.

To acquaint the oil producer and field personnel with what has transpired recently in this field, the following will discuss some of the more outstanding developments and trends in oil production equipment.

Dual Pumping Developments. Great steps have been made in the application and flexibility characteristics of equipment suitable for producing two pay zones through the same string of casing. About a dozen installations have been made using two bottom-hole pumps, two strings of tubing and two strings of sucker rods, all installed in the same casing string, with a packer to separate the producing zones.

In addition to higher original cost of equipment, this set up has, in general, proved to be unsatisfactory, due to the fact that gas troubles cannot be handled properly. This type of application will continue to be used occasionally, but the high cost of the duplicate pumping setups will cause it to be used less as time goes on.

Three of the major subsurface pump companies now have dual installations based on pumping both zones with one string of sucker rods and one pumping unit. The general characteristics of these three setups are similar but the flexibility of installation and operation varies. Only one of these seems to lend itself to almost any type of production setup desired. It enables the producer to vent gas from either the upper or lower pay, or from both if so desired. It also allows him to flow or pump either, or both, the upper and lower pay zones according to necessity. It offers further the advantage of retrieving all operating parts of the dual pump equipment on the sucker rods with no necessity of pulling tubing in order to get at some of the working parts.

A new feature is pressure-actuated traveling valves for either, or both, upper and lower pumps. With these valves, if either zone has produced its allowable but the other has not, by closing a gate valve at the surface one zone can continue to produce while the other does not, because the traveling valve becomes inoperative against the pressure of the closed-in valve.

When it is desired that the closed-in pay be put on production again, the gate valve at the surface is opened, and the traveling valve commences to operate again. This installation can be used with bottom-hole chokes and crossovers so that either the upper or lower zones can be acidized, or other type workover operations conducted without affecting the other pay.

In addition to the increased flexibility of the dual pumping equipment, much progress has been made during the past year in its proper application. Detailed dynamometer analyses brought to light operating difficulties such as rod stretch, tubing stretch, and many other problems. Much is yet to be learned on dual installations, but considerable progress has been made during the past year.

Two Stage Pumps. This type pump is basically two pumps—the oil and gas is sucked into the larger one on the upstroke, and on the downstroke is passed through a traveling standing valve into the smaller pump. On the following upstroke, the mixture is compressed so as to operate the traveling valve, and thus be discharged into the tubing. This type was designed to prevent gas locking and has proven successful, generally. It does not, however, take care of gas flow.

Many wells will pump satisfactorily for a time until the fluid level is lowered to the pump. At this point a gas flow is started from the pay into the well bore, through the pump, up the tubing, and out through the flow line and vent. In some cases the flow continues for 6 to 10 hours before enough

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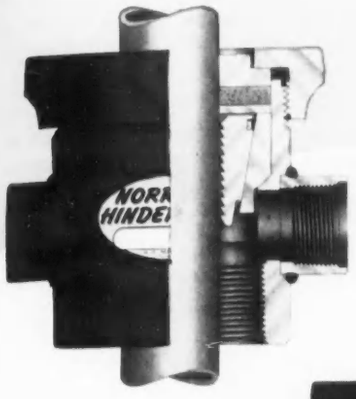

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TUBING HEAD
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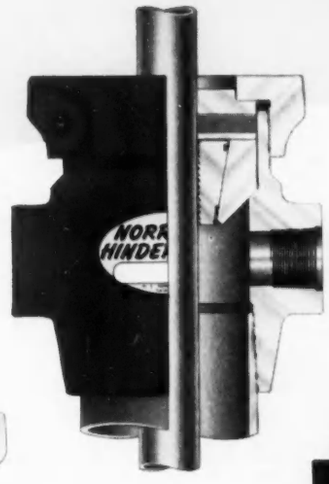
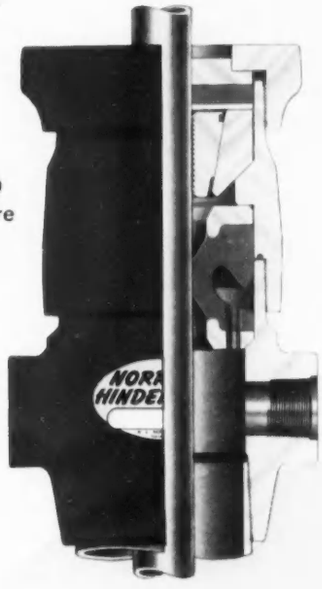
1000# C.W.P.



HW 2-in-1
TUBING HEAD
4000# Test Pressure
2000# C.W.P.

HW 4-in-1
TUBING HEAD
4000# Test Pressure
2000# C.W.P.



YLS
CASING HEAD
2000# Test Pressure
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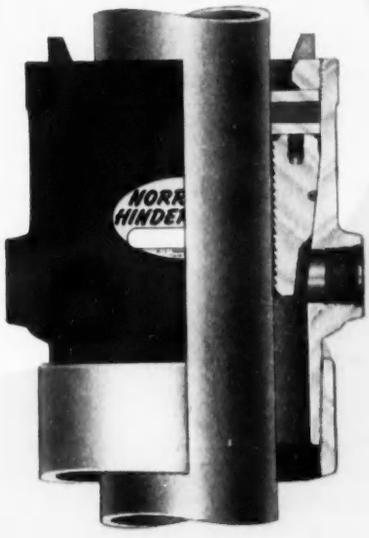

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fluid has built up to break through the gas flow conditions. In general, there is a difference between gas lock and gas flow pumping conditions. In the gas locked condition, the tubing has fluid in it, but the pump has only gas in it which is being compressed and decompressed alternately, but no fluid is being discharged into the tubing.

When the gas flow condition prevails the pump and the tubing are both empty and contain no fluid, but gas only. The two-stage type pump has proven worthwhile for gas lock conditions and is worth consideration when those conditions are present.

Three-Tube Pumps. This type of bottom-hole pump is not new, having been developed several years ago as a special pump for sandy conditions. The three-tube utilized fluid seal, rather than a metal-to-metal seal. The new developments that have taken place in the basic type pump are those having to do with the retrieving of the standing valve assembly, and with the method of discharging fluid from the pump. Ordinarily, three-tube pumps are run in and seated, then the barrel assembly is unscrewed from the standing valve assembly, the pump is spaced and put in operation with no positive connection between the traveling barrel and the stationary valve assembly. When it was desired to pull the valve assembly, it was necessary to set down and attempt to screw back on it.

Often this was unsuccessful due to sand buildup, damage to threads, corrosive action, etc. New developments enable these pumps to be run and operated exactly like a standard insert pump of any other kind. No screw-on or screw-off is necessary, and this feature has made three-tube pumps more desirable.

One other new feature now available is parts whereby some of the fluid (approximately 20 percent) can be discharged immediately above the seating cups, thereby keeping in motion any sand which is at the top of the barrels that might possibly settle out below the main discharge of the pump. This gives improved runs and this type pump can now be considered a good type for sandy conditions in almost any producing area.

Injection Pumps. This type pump is a newcomer to bottom hole installations. It is specifically for use with hollow sucker rods. Using this pump, a diluent or a paraffin solvent can be pumped down the hollow sucker rods then through the plunger, which allows the fluid to be discharged through a liner of the pump, as a port in the plunger passes a port in the liner column. This allows the desired chemicals to be introduced into the well bore at the pump and thus be carried through the pump and up the tubing, giving the corrective benefits of the chemicals to the whole string of tubing as well as to the well bore.

This pump, at the moment, is not a standard off-the-shelf item but there should develop some interesting and effective applications of it in wells where corrosion, paraffin, or low gravity conditions prevail. It is apparent that such a method of treating a troublesome well with either corrosion inhibitor, paraffin solvent or a diluent is highly preferable to the dump method in use up to this time.

Sucker Rods. Several installations have been made during the past year of the new 1⅛-inch diameter sucker rods. These rods weigh 3.67 pounds per foot and are used on very deep wells for their load carrying ability, but are also used immediately above the pump in a casing pump installation in order to have a "piston rod" effect to push down the big traveling valve assembly. This enables producers to operate casing pumps at a higher stroke per minute rate than was possible before these 1⅛-inch rods were available.

Tests are being made of aluminum sucker rods, shot-peined sucker rods, and sucker rods of special analyses of steel. None of these tests are conclusive as yet.

Pressure Control Valve. While not exactly new, the pressure-control valve has been improved and is becoming more widely used. The equipment itself is very simple consisting mainly of a globe valve type body with a spring loaded ball in place of the plug used on globe valves. By increasing spring tension acting on the ball the valve can be made to hold a certain pressure, opening only to relieve pressure buildups that occur. This valve already has many known merits and its application should increase.

Installation and proper operation of a back-pressure valve will secure the following advantages:

1. Conserve bottom hole energy in the form of gas pressure by preventing any gas flow without a concurrent liquid discharge.

2. Give longer life to balls and seats by holding them closed against gas flow thereby avoiding cutting and spinning.

3. Even out the production rate, i.e., production will be secured at a smooth rate rather than by spurts.

4. Add to the life of the packing in the stuffing box by providing constant liquid around it.

5. Lower the measured gas/oil ratio of the well because it prevents any gas discharge without liquids.

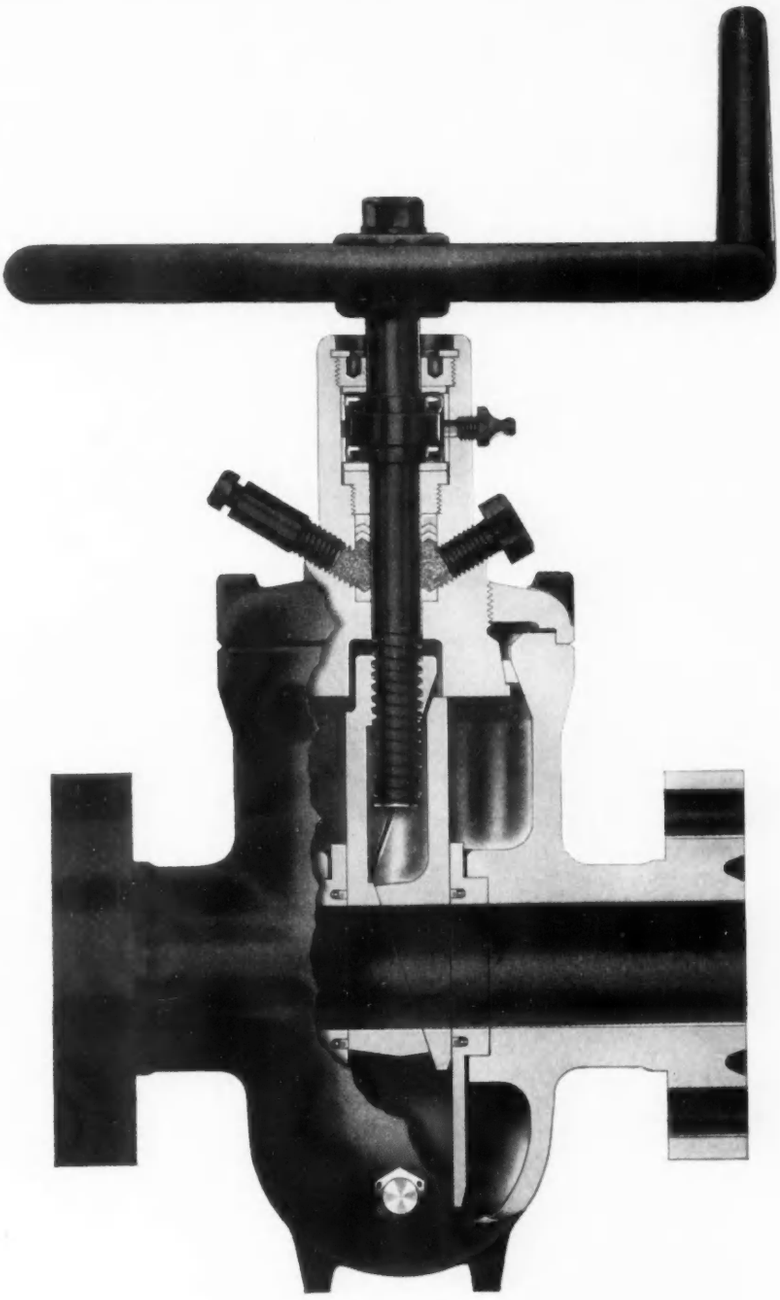
6. It enables the surface equipment to be effectively counter balanced by evening the load on the unit. It does this by preventing flow-off. This is an extreme advantage when electric motors are used as prime movers because it provides a steady demand rate to the electric motor.

7. Prevents or at least retards, paraffin deposition caused by the chilling effect of expanding gases by holding these gases in solution until they pass the valve itself.

The main fault observed with the installation of these valves has not been with the valves themselves, but with the operators who did not carry sufficient pressure to accomplish the job for which the valve was installed. In some cases it has been necessary to hold a pressure of 600 pounds per square inch in order to prevent the well from flowing by heads.

In general, the pressure-control, or back-pressure valve, has a definite application on a well in order to force the well to actually pump. The so called agitation or "flumping" (flow pumping) period of production is actually very inefficient and detrimental to the equipment and to the well itself. Experience has indicated that if a well will not flow its production, then equipment should be installed to make the well actually pump.

New developments on equipment used around the wellheads. Very recently a flow line gas separator has been developed. It is a small pressure vessel, roughly 12-inches in diame-



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ter by 22-inches high installed between the pumping tee and the flow line. The oil and gas mixture coming from the well comes into the separator from the bottom, up through an entry pipe.

The mixture then hits a baffle and is spilled over in a reverse direction. The speed at this point is reduced 25 to 1, and therefore any free gas that wants to separate has ample opportunity to do so. This free gas collects in an inverted bucket which floats. The solid fluid goes on out the top of the separator while the gas is taken out through another connection at the bottom.

This principle has been in use for years but its application as a separator at the well head is new. Its prime function was to help to provide gas to run the pumping engine when the well normally would not make enough gas through the casing. Installation of this separator will void the necessity of laying a gas line from the lease separator back to each well in order to have gas for the engines. From the economic standpoint alone, it is interesting. But even further possibilities are offered.

Using this separator in conjunction with a good fluid meter, it would be possible to have an exact check on the fluid produced from the well each day. This is advantageous where several wells are pumped into one tank battery. It is even possible with this separator to rig up a set of equipment (especially on an electric motor) whereby the pumping unit could be started by a time clock at a specified time each day. Then by using the separator with a meter and with special attachments, the unit could be allowed to operate until the allowable oil production had been pumped, regardless of the time it took to pump that amount. By setting the desired volume on the meter and having the meter trip a cutoff switch, this feature would assure the operator that his allowable had been pumped from each of his wells each day.

Ceramics. During the past year several tests were run on bottom-hole pumps equipped with ceramic balls which may prove to withstand sand, gas, and fluid cutting to a greater degree than metal balls. These tests are inconclusive as yet. Ceramics were also introduced as polish rod liners and have shown definite improvement in wear characteristics over the standard bronze liners. These ceramic items, while they are very interesting and may develop much further in the future, are definitely on test at this time.

Clamps. The past year saw the introduction of a new polish rod clamp featuring greater holding power along with quicker installation. With this new clamp, producers can obtain the flexibility needed for re-spacing the pump or for installing well-weighing instruments without sacrificing holding ability.

This clamp gets its greater power through the use of fine threads which are protected from damage or rusting by a long standard size nut. The holding power of this new clamp tightened with a 24-inch crescent wrench is equal to the holding powers of other clamps tightened with a 36-inch or even a 48-inch rigid type wrench.

Surface Production Equipment. Unit pumpers are now offered with modifications which allow longer polish rod strokes for a certain API size reducer. This type modification was brought about in order to handle increased volumes of fluid from rather shallow pays being water flooded. The torque requirements are rather low but the increased stroke is necessary in order to secure economical volumes. These modifications are now generally available and have proved entirely satisfactory.

Another modification of standard unit pumpers is that of lighter structurals than standard with rather heavy-capacity reducers. This was brought about because of the volume of relatively deep wells from which rather small fluid volumes were available. In this case, the major portion of the load is sucker rods, while the fluid load is very light. This type of loading requires high torque capacity in the reducers with a lower than normal polish rod load. This modification has proved entirely satisfactory in operation.

Due to economical as well as certain legal requirements, steel sub-bases of increased width are available now on unit pumpers. This type of sub-base does away with the necessity of the expensive concrete foundation and also gives portability and flexibility. The demand for, and application of, wide bases on unit pumpers is definitely increasing. Bases fabricated from I-Beams and H-Beams are definitely superior to those made of channel iron, or used drill pipe. The latter two types allow entirely too much weaving for the modern pumping unit and have proved to be unsatisfactory.

At least three of the accepted makes of unit pumpers now offer the advantage of the hydraulically removable wrist pins. Actually the title is a misnomer because the basic idea is that the pressure built up with a grease gun is only an aid to the sledge hammer. It was never really intended that the wrist pins should be pumped out 100 percent with the grease gun pressure. These types of wrist pins give oil producers greater flexibility in applying the unit pumper at the proper stroke length needed over the life of the well. With them the polish rod stroke can be easily and quickly changed. This definitely was not true until this feature was introduced.

Most of the accepted makes of unit pumpers during the past year followed lines previously indicated by offering controlled type counterbalances. Some companies use screw adjustments while others allow the counterweights to pivot easily around a bearing to the desired position, but the effect secured by both methods is the same. These counterbalances are safer and easier to operate and the average pumper will keep his well in better counterbalance when it does not mean a half day's work to insert weights which might be either too great or too small.

One manufacturer's unit pumpers have been lightened in weight by using good and accepted engineering design. This light weight is desirable for several reasons such as portability, setting, as well as the saving in freight. The old idea of "if it's good, it's got to be big" may be on the way out insofar as unit pumpers are concerned.

In line with the specific application of unit pumpers as well as the new designs which have followed, dynamometers are now being used in greater measure than ever before to check on the actual loads imposed by the well, the counterbalance effect secured, the horsepower required from the engine, and the operation of the bottom hole pump. The use and intelligent analysis of dynamometer cards, result in definite savings to the

operator not only on his equipment but in his production methods.

V-Belt Drives. One supply company is offering application recommendations covering V-Belt drives which base the belt requirements on the torque capacity of the gear reducer, and do away with the old hp/ft. per minute application by which V-Belts were applied to industrial and farm uses. This method of application tailors the drive for the unit pumper on which it is applied and provides the highly desirable resiliency which the old application methods did not give. Greater life of gear teeth, bearings, clutch shafts, etc., can be expected with the use of the torque drive application.

On the general subject of prime movers there have been no startling developments during the past year although several new engines were brought out. They were merely different sizes of regular type engines. The trend is towards use of the single cylinder, horizontal, medium speed engine designed for the oil fields, and used in the oil fields only. It indicates that equipment used in the oil fields should be made for use in the oil fields and not for use on a compressor, a generator, or a hammer mill on the farm. Several manufacturers have increased flywheel weight on their engines in order to cut down on the cyclic variation. This variation proved to be not only undesirable but actually damaging to gear teeth and bearings, and it is well that flywheels have been made heavier.

Electric motors continue to gain in applications on unit pumpers. They are clean and easy to operate but they do not allow flexibility in the operation of the unit pumper. Sometimes this flexibility is highly desirable. In general, electric motors are installed to counteract the poor quality of pumper available to operate production equipment and in this light they are a good development.

As equipment becomes more tailor-made to well conditions, increased knowledge is necessary concerning the application of this equipment. It imposes an obligation of operational checks and operational maintenance which oil producers cannot and should not avoid.

ACKNOWLEDGMENT

This article is based on a paper presented at the West Texas Oil Lift Methods Short Course sponsored by Texas Technological College, Lubbock, Texas.

FIGURE 1—Typical new pumping equipment in the Healdton field of Southern Oklahoma.

Modernizing Equipment Cuts Operating Costs

• Shell Oil Company replaced obsolete pumping equipment with automatically-controlled individual electric motor-driven units on 464 wells in southern Oklahoma.

• Savings in operating costs alone promise to yield a 353 percent return on an investment of $900,000.

By FRANK POORMAN, Shell Oil Company, Centralia, Ill.

A MAJOR EQUIPMENT modernization program recently completed in southern Oklahoma by Shell Oil Company demonstrates considerable benefits. Modernization of 249 wells in the Healdton field increased production 10.4 percent although the number of wells operated decreased 27 percent. At the same time, operating costs were reduced 45.6 percent.

On the basis of achievements in the Healdton field, it is indicated that possible operating-cost savings alone may return an undeferred net profit of $3,177,000 or 353 percent on the investment of $900,000 for modernization of 464 wells in southern Oklahoma. The project involved replacement of 20 to 40-year old rod-line central powers or rig fronts with individual electric motor-driven pumping units.

One of the major problems facing many operators is the profitability of replacing obsolete worn-out production equipment on low-income stripper wells. Many of these wells are produced with obsolete worn-out equipment which has high operating cost and low production efficiency. Where production equipment is in poor condition, operators suffer loss or production, reduced net profit and probable reduced ultimate production.

Although the data presented were obtained from specific properties, they may be useful to others considering similar modernization projects. However, equipment modernization should not be regarded as a panacea to be applied to all stripper production. Production rate, reserves, life, operating costs all should be analyzed carefully before undertaking major expenditures.

Conditions leading to equipment replacement. A great portion of the major production equipment on Shell Oil Company's older southern Oklahoma properties had been installed when the wells were completed originally and was from 20 to 40 years old. In most instances, operations had become excessively expensive because of the age of this equipment and, in some instances, equipment had failed completely. Continued operation of these leases had, therefore, become a major problem. Additional impetus was given to the need for replacement of this equipment because:

1. The old wells had substantial reserves and an average remaining life in excess of 20 years.
2. Deeper horizons under many of the older properties and under adjacent new leases were being exploited.

A summary of the prevailing conditions in these older fields is presented on Table 1.

There were, therefore, two alternative approaches to the problem:

1. To continue operation of the old stripper production by repairing the original equipment and re-

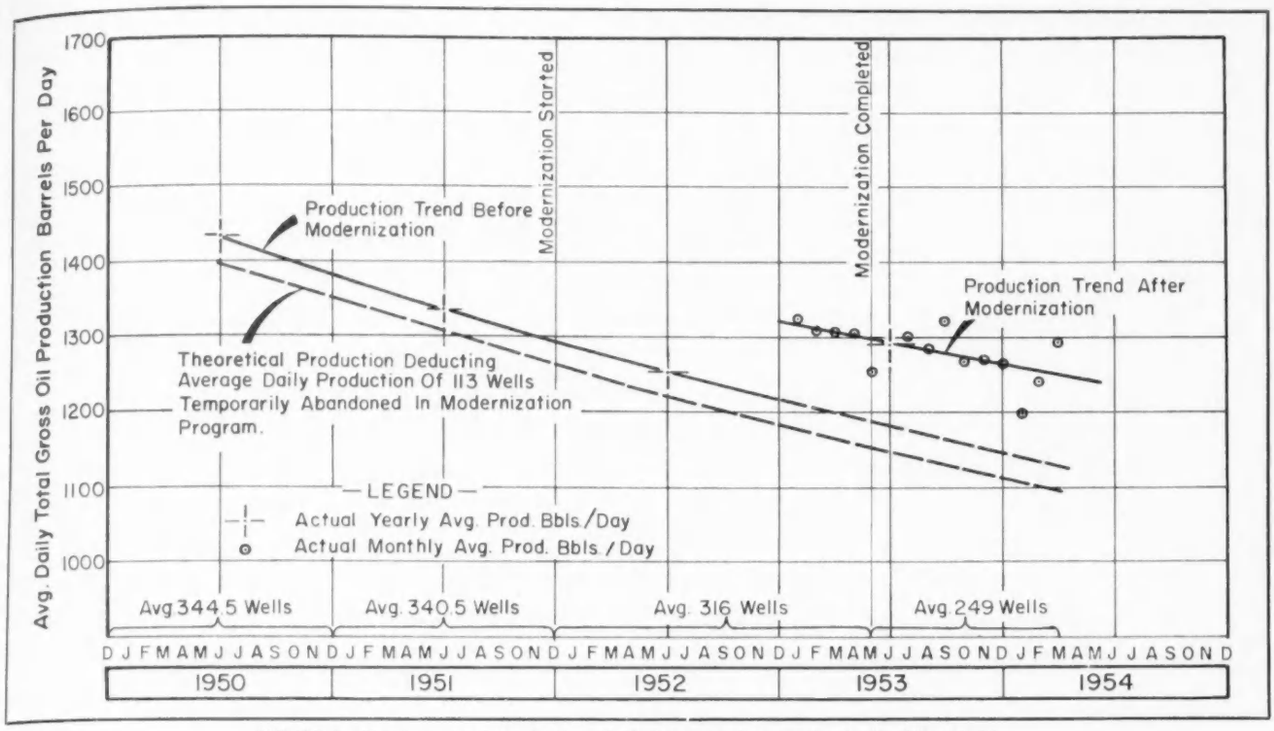

Avg. Daily Total Gross Oil Production Barrels Per Day
1700
1600
1500
1400
1300
1200
1100
1000
Modernization Started
Modernization Completed
Production Trend Before Modernization
Production Trend After Modernization
Theoretical Production Deducting Average Daily Production Of 113 Wells Temporarily Abandoned In Modernization Program.
— LEGEND —
Actual Yearly Avg. Prod. Bbls./Day
Actual Monthly Avg. Prod. Bbls./Day
Avg. 344.5 Wells
Avg. 340.5 Wells
Avg. 316 Wells
Avg. 249 Wells
D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1950
1951
1952
1953
1954

FIGURE 2—Total gross oil production of Shell-operated properties in Healdton field.

placing component parts as failure occurred; or

2. To undertake an equipment-replacement program on a scale never before attempted by Shell on old stripper production.

In either case, the new production would be electrified to provide efficient pumping installations requiring minimum operating expense.

A thorough investigation of the problem resulted in the adoption of the latter alternative for the following reasons:

1. Electrification and accompanying automatic controls would reduce operating expense and reduction of manual operations would make it possible for operating personnel to do more important work and assume greater responsibility.
2. Production would increase because of more efficient operation.
3. The cost of modernization would be repaid by savings in operating costs alone.

Healdton field program. Although much of the advanced planning was started as early as 1946, the first concentrated replacement of this deteriorated equipment was undertaken in the Healdton field during December 1951. By May 1953, some 249 wells had been equipped with individual beam-pumping units driven by electric motors. A detailed discussion of this project, which is representative of the entire program, is presented. This field is particularly amendable to analysis because:

1. Adequate cost records, prior to modernization, are available.
2. There has been no new development which would render a comparison with former operations invalid.
3. Modernization has been completed for a sufficient period to establish definite results.

This is the largest single project in the over-all program and represents approximately 51 percent of the total expenditure for modernization.

Although it was recognized that this field might later be water-flooded, immediate modernization was undertaken because it was believed that the investment for equipment necessary for primary recovery would be returned through savings prior to any flooding operations. In addition, much of the new equipment could be utilized in any subsequent secondary-recovery project.

For modernization purposes, the leases of the Healdton field were grouped into contiguous operating blocks of leases. The condition of equipment on each block was analyzed and considered along with allied reserves, operating costs and remaining life, and a careful evaluation was made of possible operating savings to be obtained with modern equipment.

An estimate of the cost for each project indicated an individual well expense of approximately $1835. The

TABLE 1
Conditions Prior to Modernization

FIELDS	Originally Developed	Productive Zone	Depth, Feet	Surface Equipment
Healdton	1913–1918	Pennsylvanian	900–1,200	Central powers with gas engines, rod lines, wooden or steel Oklahoma jacks.
Hewitt	1920–1921	Pennsylvanian	1,600–2,800	Central powers with gas engines, rod lines, wooden or steel Oklahoma jacks.
Tatums	1926–1927	Pennsylvanian	1,500–2,500	Wooden rig fronts with gas engines, back-cranked wells and central powers.
*Other Properties	Late 1920's	Pennsylvanian Permian	1,300–3,500	Wooden rig fronts, single-cylinder gas engines, and central powers.

*41 leases in the Fox-Graham, Carter-Knox, and Sholem Alechem Fields.

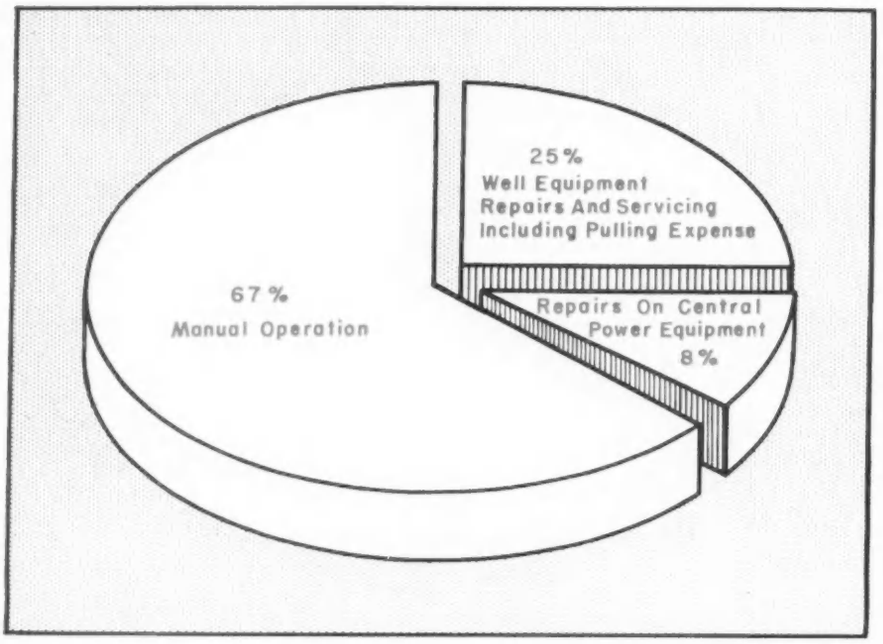


FIGURE 3—Direct lease expense savings from modernization at Healdton field.

minimum production rate necessary to return this cost was found to be one barrel of oil per well per day. The wells to be included in each project were determined on the basis of an accurate three-day production test. As a result, 113 wells producing a total of 34 barrels of oil per day (0.36 barrels of oil per well per day) were abandoned temporarily.

A list of the major items of production equipment used on the average well and the major construction steps followed in this modernization project are itemized in Table 2. A photograph of a typical completed well installation is shown in Figure 1.

It was usually necessary to replace the bottom-hole pumps in these wells, because the existing cup-type pumps were too large for the well fluid capacity and would have overloaded the small unit pumpers and electric motors. These pumps were replaced with metal-to-metal sectional liner pumps in order to reduce well-servicing costs.

The construction was so scheduled that excessive loss of production from down time was prevented. After each well was equipped, the equipment carefully was checked for pumping load and proper sizing of motor protective devices. Individual pumping schedules were determined by use of a recording pump-off indicator and the load on the power source was balanced, insofar as possible, by the proper scheduling of part-time producing wells. Back pressure on the formation caused by fluid in the well bore is being kept to a minimum, thereby assuring the maximum rate of production from each well. In general, wells are operated at the slowest practical speed to reduce horsepower and energy requirements.

Also, as equipment modernization progressed, a reduction in manual operating requirements was achieved. This made it possible for operating labor force to be reduced on the leases thus affected. It was not necessary, therefore, to fill certain vacancies occasioned by normal retirements on pensions, and transfer of some of the men, made available through modernization of these properties, enabled new fields to be operated without increasing the labor force in southern Oklahoma. Replacement of obsolete equipment, electrification, and accompanying automation also afforded a reduction in the more strenuous duties required. Elimination of the necessity for starting large engines and operating other heavy equipment made the work easier for our older operating employes.

Effect on production and expenses. A summary of the results of modernization in the Healdton field is presented in Table 3.

By extending the production curve prior to modernization and comparing it with actual production subsequent to modernization, Figure 2, it will be noted that an additional 44,000 barrels of oil per year, or 10.4 percent increase, is being obtained. This increase in production was achieved even though approximately 27 percent of the wells were temporarily abandoned because they could

Continued on Page 166

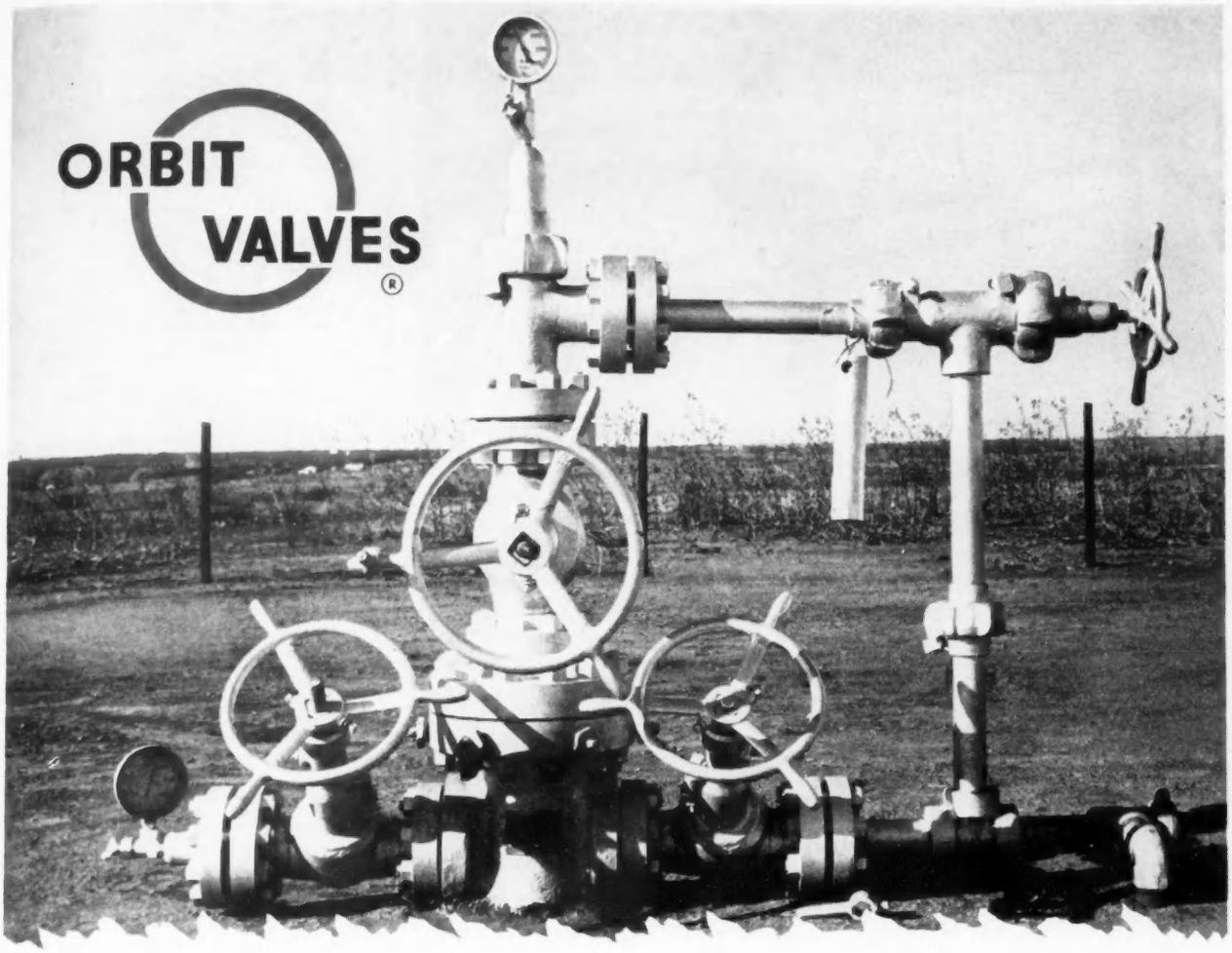
TABLE 2
Major Production Equipment Used On An Average Well in the Healdton Field

Quantity	Description	Cost
1	1.2 nominal horsepower unit pumper (6,400 in-lb. gear reducer and 3,200-lb. polished rod load rating)	$600
1	1-hp, 3-phase 60-cycle, 440-volt, 1,200-rpm electric motor	75
1	1-in. or 1 1/16-in. rod sectional liner traveling barrel pump	120
1	NEMA Size 1, 3-phase, 440-volt motor controller containing overload heaters, fusetrons, time clock, and lightning arrestors	185

TABLE 3
Comparison of Electrified Individual Units Vs. Obsolete Central Power Operations—Healdton Field

	CENTRAL POWER (Cost Based on 1951 Operations)	ELECTRIFIED (Based on Period June 1953 Thru March 1954)	CHANGE DUE TO MODERNIZATION			
			Amount		Percent	
			Increase	Decrease	Increase	Decrease
No. Shell operating wells, gross average	340.5	249	....	91.5	....	26.9
Production, bbl. per year: Total Gross	421,600	465,600	44,000	....	10.4	....
Shell Net	325,200	359,290	34,090	....	10.5	....
Gross barrels of Oil per man-hour	11.2	24.9	13.7	....	122.3	....
Avg. gross oil production per well, bbl. per month	103.2	155.8	52.6	....	51.0	....
Avg. man-hours per well month	10.2	6.2	....	4	....	39.2
Value of Shell net production, dollars per year (At Avg. of $2.718 per bbl.)	$883,894	$976,550	$92,656	....	10.5	....
Net direct lease expense, dollars per year	.....	.....	....	....	....	45.6
dollars per gross well, monthly	.....	.....	....	....	....	25.6
dollars per net barrel	.....	.....	....	....	....	50.8
Operating income, dollars per year (value Shell net)	.....	.....	....	....	22.4	....

Direct Lease Production Expense:	
Total Cost of Modernization	$459,229.00
Payout Cost of Shell's share from net operating savings only	5.92 years
Payout on Shell's share from Shell's net increased operating income	2.56 years
Estimated Profit from Reduced Operating Cost Only (Modernized wells vs. continued operations with old central power equipment, replacing component parts as failure occurred):	
End first 10 years after modernization, including payout period	$287,700.00
End of 20 years	922,000.00
End of 30 years	1,480,000.00



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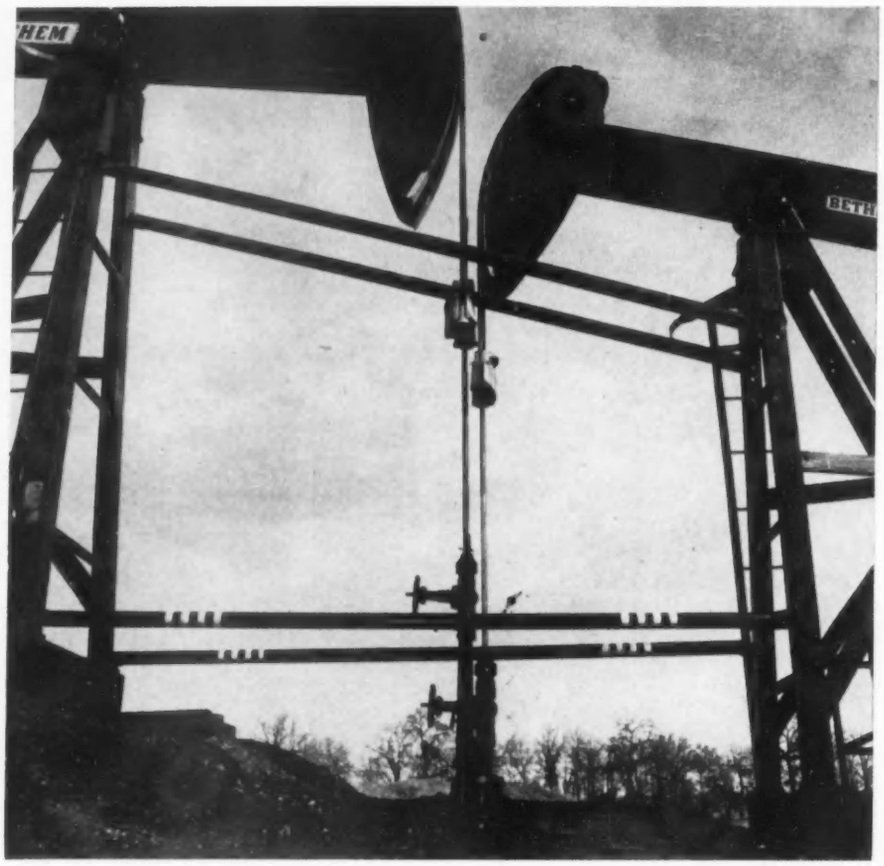

FIGURE 1—Wellhead hookup for two pumping units set on one dually-completed well.

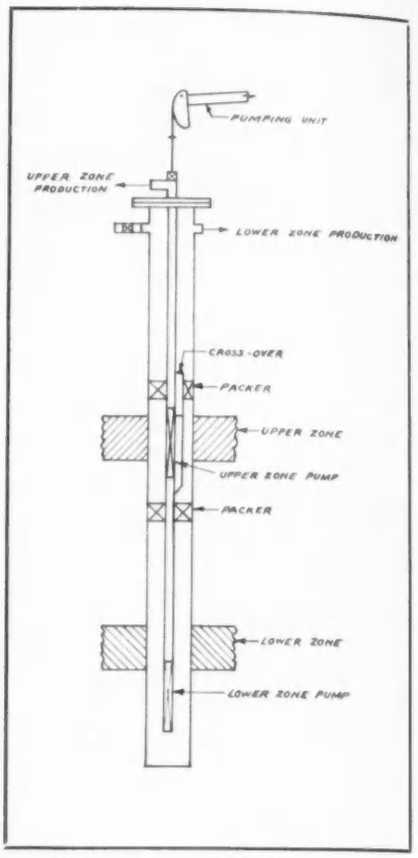

FIGURE 2—Conventional hookup for two-zone pumping with one unit.

Two Units Pump Dually-Completed Well

Stanolind's unconventional twin installation proves successful in southern Oklahoma.

By GEORGE E. O'NEAL, Stanolind Oil and Gas Company, Tulsa

STANOLIND OIL AND GAS COMPANY'S dual pumping installation in the Velma field of southern Oklahoma, employing two independent sucker rod systems in one well, is admittedly not a universal solution to the problem of pumping dual completions. However, it appears to be quite satisfactory for the area involved. Figure 1 shows the wellhead assembly.

The economic advantage of drilling one well that can be made into a dual completion is quite obvious when compared to the expense in drilling and equipping twin wells. The dual completion does create a production problem. As long as both zones are flowing naturally, no special difficulties are encountered. However, mechanically lifting two zones without comingling the produced fluids, brings about complications, the solution of which taxes the ingenuity of both operators and manufacturers. Many different arrangements and devices are employed, some of which are successful, and some are not.

Depth to the two zones varies with the position of a well on the steeply dipping structure. The depth to the Deese sand varies from 3800 to 4000 feet and to the Springer sand from

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FIGURE 3—Sampson posts of both units are tied together by four crossbars to insure their relative positions. Elevation of the near unit had to be made higher than the second unit to provide proper horsehead clearance.

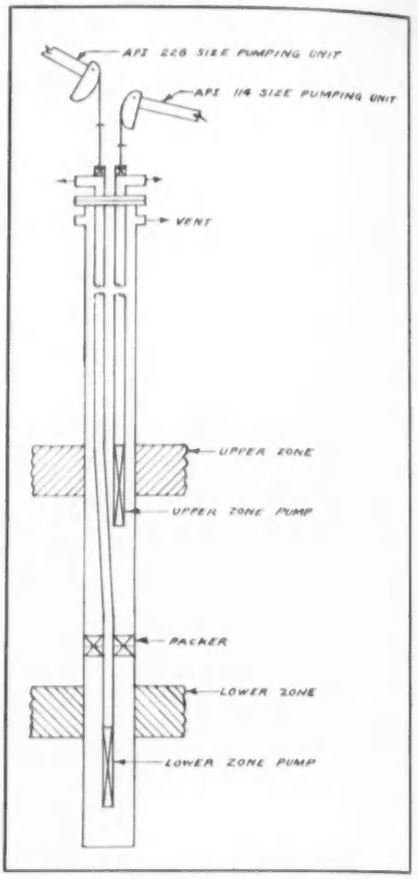

FIGURE 4—Schematic diagram of Stanolind's successful but unconventional two-unit hookup on dually-completed well.

4500 to 6500 feet. The interval between the two zones therefore varies from 700 to 2100 feet.

When it first became necessary to apply artificial lift to the wells in this field Stanolind installed a conventional, commercially available, two-zone pump as shown schematically in Figure 2. In such an installation, two pumps are used in the well inside a single string of tubing and are operated by a single string of sucker rods.

Two packers separate the zones and provide a means of keeping the production from each zone separate. The bottom zone production is pumped through the tubing to the bottom of the upper pump; thence through a crossover and transferred to the casing annulus above the upper packer. The upper zone production is pumped through the tubing.

Problems develop. For a time, these installations were satisfactory. Eventually, however, as the gas-oil ratio of the upper zone started to increase, the operating difficulties began to multiply. The gas pound in the one zone imposed shock loads on the whole system. The decrease in pump efficiency made it necessary to operate the installation with excessive length of stroke in order to secure the needed production.

All of the pumping equipment was subjected to unnecessary loadings and the operating costs were high. It became quite apparent that—first, some means would have to be provided to vent the gas from the upper zone so it would not have to be handled by the pump—and second, that flexibility must be given to the installation to permit taking care of the different production characteristics of the two zones.

Stanolind's equipment engineers, in considering the problem, came to the conclusion that for existing conditions, two independently operated sucker rod strings, will provide the most satisfactory solution. An API 114 pumping unit was selected for the upper zone and an API 228 unit selected for the lower zone.

Installation design. Design of the installation involved much more than simply purchasing the two units and setting them on their regular foundations. A scale layout was made to check the clearances between the horseheads of the pumping units as well as the clearances between the two carrier bars, polished rod grips, polished rods and stuffing boxes.

In order to get the clearances needed, it was found that it would be necessary to shorten the wire line reins and to elevate the larger pumping unit two feet above the base of the smaller unit. Stuffing boxes were stag-

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gered and their outside diameter reduced three-sixteenth of an inch to provide clearance between the boxes and the tubing. The clearance between the horsehead of the smaller unit and the carrier bar of the larger unit is three-sixteenth of an inch.

The V. Banks 15 was selected as the site for the test. The surface installation is shown in Figure 3. The four bars between the pumping units were provided to keep the units in position. Since this was a test installation, the units were set on temporary timber foundations. Figure 4 is a schematic drawing of the surface and subsurface arrangement of the installation.

Since the lower zone, or Springer formation, of the well selected had a relatively low gas-oil ratio, it was decided for sake of simplicity not to use the venting arrangement of the subpacker formation in this test installation. The subsurface equipment of this zone consisted of a 1½-inch pump set at 5000 feet, 2-inch EUE tubing, ¾-inch rods, and a packer set at approximately 4500 feet.

The upper, or Deese zone, subsurface equipment consisted of a 1½-inch pump set at 4360 feet, 2-inch EUE tubing, and ¾-inch rods. The tubing strings were run simultaneously without difficulty and were not fastened together. The entire installation was put on production in June, 1954.

Table 1 shows the results of the tests, It may be noted, first that there was a substantial increase in the production of the upper zone as a result of venting gas through the annulus. The increase in the lower zone was rather negligible which may be ascribed to the fact that, as stated before, no venting arrangement of the subpacker zone was made for this installation.

Operating expenses cut. This feature will be provided in future installations. Increasing production, however, is only one part of the story told by the table. It may be noted that the increased production has been secured with a smaller pump than previously used and with shorter stroke and at a lower speed of operation. This decrease of loads practically eliminated the operating difficulties encountered previously at this well and resulted in considerable decrease in operating expense.

One of the difficulties, which was expected and which did not materialize, was the possible effect of pumping motion of the tubing on the holding capacity of the packer. Since the tubing of the upper zone was free and not tied to the lower zone tubing, it was expected that the motion of the shorter string might result in pounding on the longer string and might either damage the string or cause eventual leakage of the packer. The installation has been in operation now for over nine months and periodic tests of the gravities of the two zones indicate that there is no communication between the two zones.

TABLE 1

Comparison of a Two-Zone Pump and a Dual Pumping Arrangement

(Average of Three 24-Hour Tests)

Zone	Method	SPM and Stroke Length	Pump Size	Oil Bbls./ Day
Deese....	Two-zone pump	16-54"	1⅝"	10.8
	Dual pumping	13-24"	1½"	42.5
Springer	Two-zone pump	16-54"	1¾"	37.8
	Dual pumping	14-24"	1½"	43.9

Investment. A rather obvious question would be in regard to the economics of investment in such an installation. It is true that the investment in pumping equipment is doubled over some of the other methods of pumping dual wells. It should be realized, however, that a dual zone well is actually a two-well installation and when investment is considered from this point of view it is not excessive. It is true that it would be highly desirable to operate two wells with investment of a one-well installation and that this may be done satisfactorily under certain conditions.

However, if the conditions are such that operating costs become high because of the operating difficulties encountered, then the investment in the two-pumping unit installation will be paid out in a relatively short time, both from increase in production and decrease in the lifting cost.

The well remains on a test status for additional data. Two additional installations of this type are now being made in the Purdy Field of southern Oklahoma. —The End

Modernizing Pumping Equipment

Continued from Page 160

not support modernization expense.

Making optimum use of the field operating force, net direct lease expense would be decreased approximately 45.6 percent as a result of modernization. The source of these savings is presented in Figure 3. The saving in operating expense alone would return the cost of modernization in approximately six years. If the value of increased production is added to these savings in operating costs, the investment would be returned in approximately 2½ years at an annual rate of some $163,000. When compared with continued operations by repairing the old equipment and replacing component parts as needed over a 30 year period, modernization would result in an undeferred net profit of $1,480,000, or 354 percent, on Shell's share of the total investment of some $459,000 for the Healdton field modernization.

In all, 464 stripper wells were equipped with individual unit pumpers, electric motors, and automatic well controls at a total cost of approximately $900,000. A total undeferred net profit of approximately $3,177,000, or 353 percent, appears possible solely from reduced operating costs.

As a result of the over-all program, 156 wells were abandoned temporarily or plugged because they could not support the cost of new equipment.

Conclusions. By an expenditure of some $417,000 for the replacement of deteriorated production equipment on 249 wells in the Healdton field, the following results are indicated:

1. Gross oil production increased some 44,000 barrels per year, or 10.4 percent, while the number of operating wells decreased approximately 27 percent.
2. Making optimum use of the field labor force, a $70,500 per year reduction in direct lease operating expense would be obtained, 67 percent attributable to reduced equipment repair and well-maintenance costs.
3. This operating saving would result in an undeferred net profit of $1,480,000, or 354 percent on the investment, and would return the

About the Author

FRANK POORMAN began working for Shell Oil Company in 1948 as engineer's clerk while attending college. Since 1950 he has been in the company's engineering department and currently is located at Centralia, Ill. He received a B.S. degree in Mechanical engineering in 1948 and an M.E. degree in 1949. Both degrees are from the University of Oklahoma.

expenditure through savings alone in approximately six years.

4. The $163,000 per year increase in income from increased oil production and decreased operating expense would repay the investment in approximately 2½ years.

Achievements in the Healdton field indicate the following results for the over-all program:

1. An undeferred net profit of approximately $3,177,000 or 353 percent, on a total expenditure of approximately $900,000 for the modernization of 464 stripper wells in southern Oklahoma appears reasonable, solely from savings in operating cost.
2. Although substantial increases in production should accrue from the over-all program, a direct analysis is not presently practical because of the effect of the development of new producing horizons on the leases and because insufficient time has elapsed since conclusion of the over-all program.

ACKNOWLEDGMENT

The author wishes to thank the management of Shell Oil Company for permission to publish the data presented in this paper. He also gratefully acknowledges the work of the many Shell engineers and operating personnel who contributed to the successful completion of the modernization program reported in this paper. This article was presented under the title of "Resulted of Modernization of Obsolete Pumping Equipment in Southern Oklahoma" as a paper before the Spring Meeting of the Division of Production of the American Petroleum Institute, held at Amarillo, Texas, on March 23-25, 1955.

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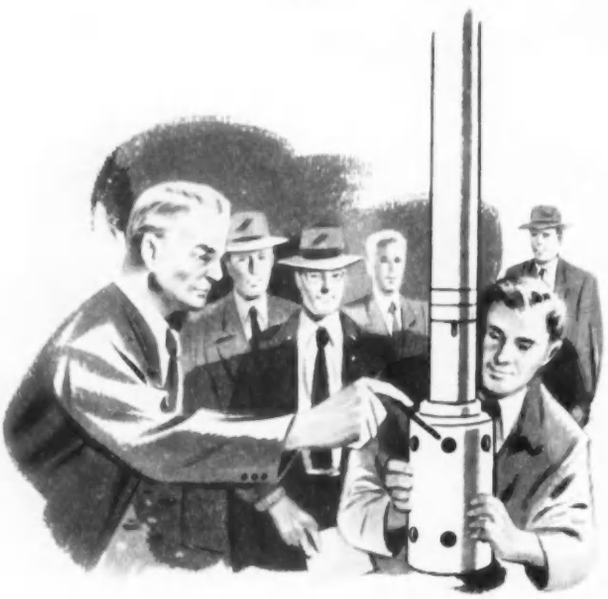

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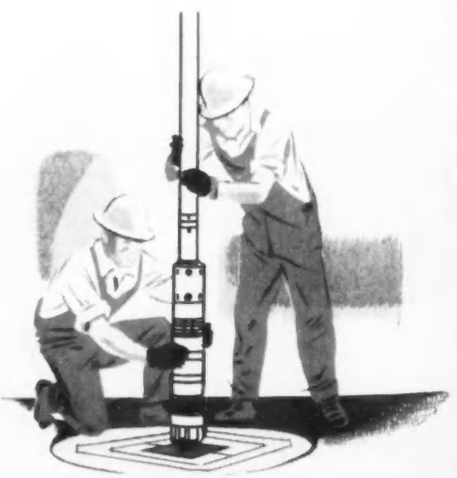

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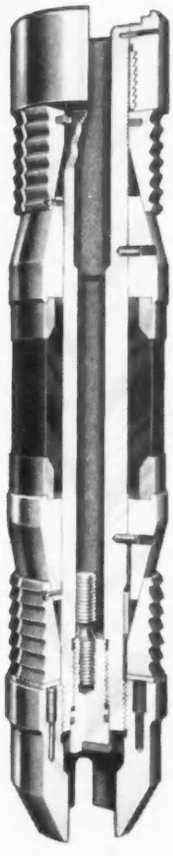

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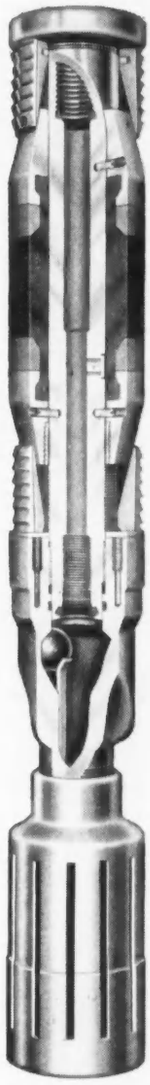

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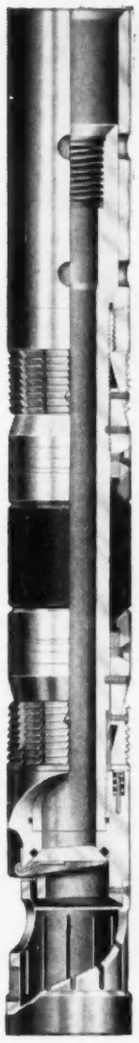

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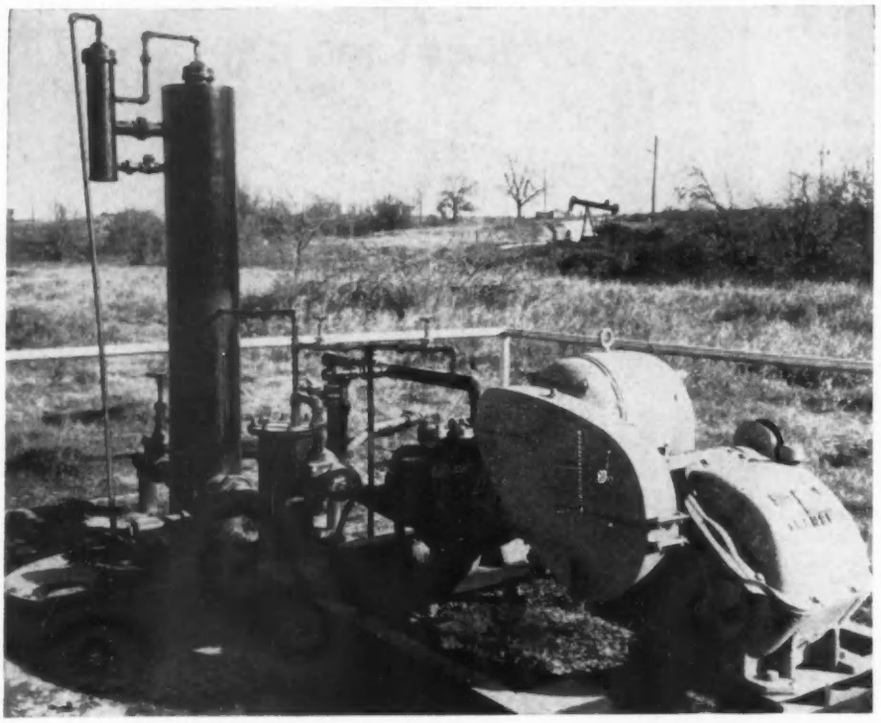
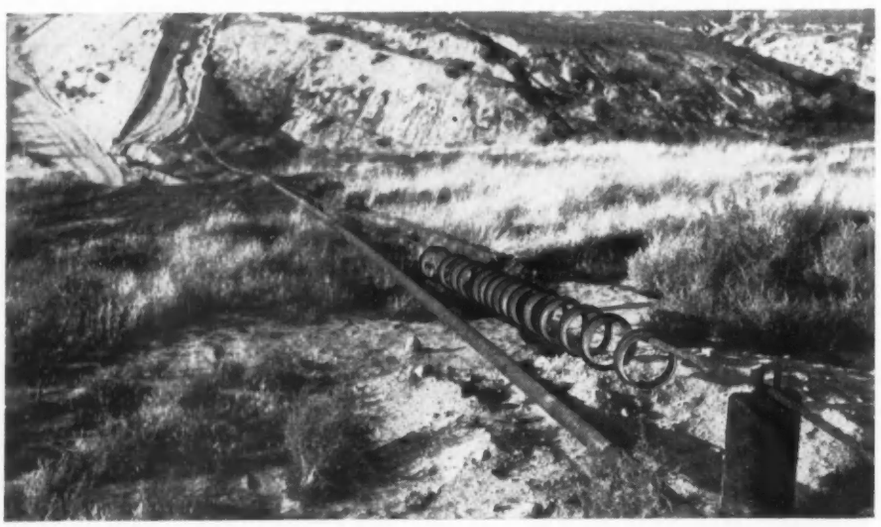


Traps Prevent Air from Entering Pump

Two traps placed on the field pump suction line will prevent any air from entering the pump. The first trap acts as a scrubber. Any air that is in the line will rise to the top and a float in the side chamber will keep the vessel from overflowing. A second trap, just downstream, is equipped with a float and a mercury switch which will shut off the electric motor when the oil level falls.

The large trap is made of 12-inch pipe with welded inlet and outlet connections a few inches from the bottom. Near the top, a two-inch nipple is welded on the side to support the float chamber. A check valve connection is welded just beneath to effectively drain the float chamber, yet not allow fluid to enter without first overflowing the large chamber. At the top, a three-inch connection swedged down to a half-inch allows the oil overflow to operate the float. When float shuts off the line leading out the top, any leakage runs back into the sump.

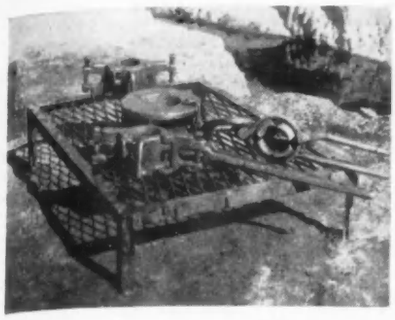
The second pot contains a strainer and a float in a side chamber which operates the cut-off switch. As long as the strainer chamber is full of oil, the switch is closed and the motor runs.



String Spare Rings on Suspension Cable

A common practice, when swinging a flowline or small pipe line across a gully, is to support it on a wire line on which has been strung a number of casing thread protectors. Spotted at intervals along the length of the span, these rings provide a dependable support, are easily moved along and placed as frequently as desired. Being several inches in width, they offer broad support for the pipe and a wide bearing on the wire line.

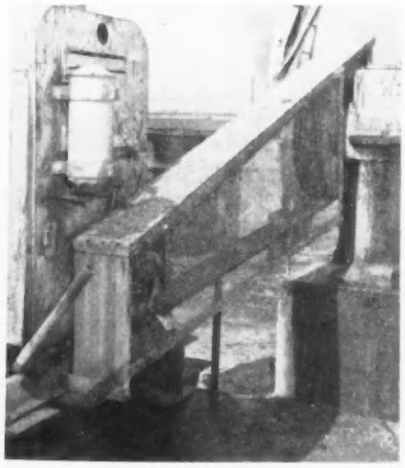
A good practice to follow when installing such a suspension bridge is to string about twice the normally required quantity of these thread protectors on the cable before the cable is anchored at both ends. The extra set can be pushed up and "stored" at one or both ends of the line near the deadmen. If the flow line has to be replaced with a larger one, or if the first set of protectors should rust out and require replacement, the extra protectors already strung on the cable will eliminate much lost time and expense.



Welded Open-Top Table Speeds Tool Handling

With the tool rack used by the well-pulling crew often consisting of the top of an overturned drum, any handy box or other makeshift surface, one operator designed and built an all-welded rack or table for the crew.

Shown in the photograph, the table is built of 2-inch angle iron and is decked over with a heavy grade of expanded metal. It is as high as the working height of the well head when pulling or running tubing, and a man need not exert himself in handling heavy spider, bowl, elevators and other tools. The table is sturdy enough to withstand hard usage, and the open decking, besides providing a non-skid surface, allows oil to drain off the tools when not in use. It also simplifies the cleaning-up work when the job is completed.



Make Belt-Driven Guard Of Salvaged Materials

There are occasions when, on rigging a new prime mover to the pumping unit, the old belt guard either is missing or, because of the changed drive and length of belts, will not fit the new installation. To erect a field-assembled unit, one operator found that good use could be made of sal-

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You'll have more production time... less maintenance time with a D+B 3-Tube Pump on your sandy well.

The three telescoping tubes are loose-fitting and free-falling to handle excessively abrasive fluids. The D+B 3-Tube Pump also operates efficiently at high bottom hole temperatures.

The loose-fitting, precision ground plunger prevents sticking and sets up a turbulence that keeps the sand in suspension. An optional bottom discharge valve assembly aids in scavenging sand from the annular space between tubing and pump. The middle or standing tube is induction-hardened to provide longer life and eliminate galling.

D+B 3-Tube Pumps are available in both positive-pull and removable-key types in lengths of 12′, 15′, 18′ and 25′. Call your nearest CONTINENTAL or D+B store for details on sub-surface pumps and parts.

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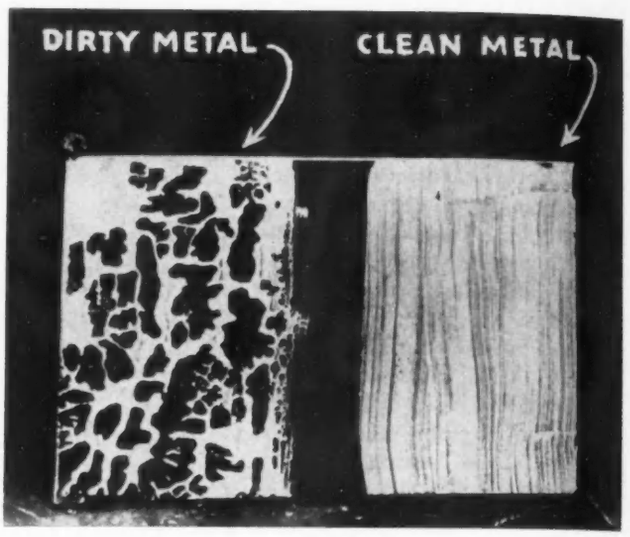
vaged tank steel and angle iron material. The sheeting was chosen as existing bolt holes facilitated assembling the new guard.

Assembled in the manner shown, with tank steel extending along the top and at both ends and with sides remaining open, the unit required a minimum of welding and bolting to make a sturdy framework. The sides were enclosed with a screen mesh material.

The resulting guard represented a minimum of outlay both in materials and in labor, and could be dismantled or otherwise altered easily to suit changing well or prime mover conditions.

Flux Can Indicate Bad Surface for Brazing

The left side of the photo shows how flux behaves on an oily steel surface; the section on the right had been cleaned thoroughly and degreased before applying flux. An attempt to braze the surface on the left would probably result in poor wetting of the metal and a mechanically weak and leaky joint. If flux wets poorly, the most economical thing to do is to clean and degrease before brazing.



To clean, first use a vapor degreaser or solvent. Then remove any oxide by pickling or by using an abrasive wheel or belt. After cleaning be careful, too, not to touch the joint faces. A greasy fingerprint can do as much damage as a patch of oil.

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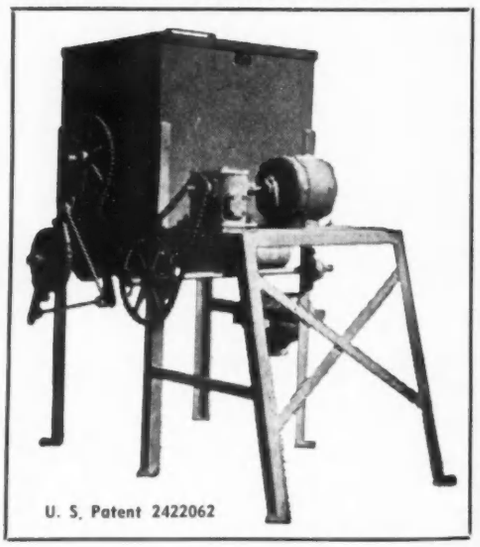

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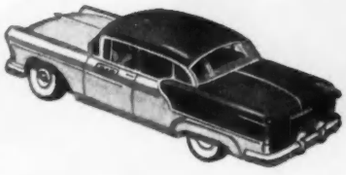

One of the men in this cellar is an O-C-T Service Man. Only a few hours earlier, he had been alerted for the job and he made it his business to get there without delay.

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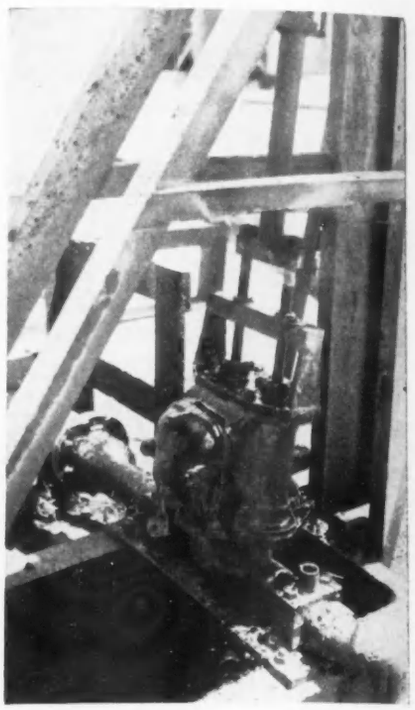
When heavy, sand-laden crude or dirty oil must be moved from one lease point to another, a tail pump utilizing the fluid end of a duplex type plunger pump can be installed on a nearby oil well pump jack. Bolted to a steel plate behind the Sampson post, the pump body should be installed in a vertical position with intake and discharge lines extending out on either side. A special cross-bar and yoke, to permit both plungers to move simultaneously and in the same direction at each stroke, is part of the minor modification work necessary. Also, long threaded sections should be provided on the pump rods, and at other points in the rod connecting the plungers to the pumping unit beam, to facilitate close adjustment of the necessarily-short stroke of the plunger pump.

Depending upon frequency of use and pressures developed in the pump system, it may be necessary to make minor adjustments in the counterweights of the pump unit.



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Simple Locking Device Thwarts Drum Pilfering

A simple, effective drum locking device can be made in only a few minutes. A six-inch length of one-inch pipe, threaded to fit the drum vent opening, is welded closed, and a short length of chain is welded near the end of the pipe. When the drum is placed on its rack at the lease, the plug is screwed in and the chain left hanging.

All that is necessary, when the drum is locked, is to slip a padlock through the link closest to the built-in hasp on the drum gate. This not only locks the gate securely but, because the vent plug cannot be unscrewed, it also is impossible to roll the drum over and drain fluid through the outlet.

Personnel launches used by Creole Petroleum Corporation undergoing semiannual overhaul at the company's La Salina boat yard.

South American 'Navy' Tends Maracaibo's Oil

• For 25 years Venezuela operators have faced tough transportation problems of marine operations.

• Here's how they have solved most of these problems and what they're planning for the future.

RISING OUT of the eastern side of Lake Maracaibo is a billion-dollar forest of steel derricks from the lake's 2700 oil wells. These, together with another 3400 wells onshore, comprise the producing area of Western Venezuela known as the Bolivar Coastal field, which produces 1.2 million barrels of oil daily, or 9.2 percent of the world's total.

About the size of Lake Erie, Lake Maracaibo is a pear-shaped body of water extending 115 miles in length and up to 70 miles in width for a total area of 5000 square miles. Wells currently are being drilled and oil is being produced as much as 15 to 18 miles offshore in water up to 100 feet deep.

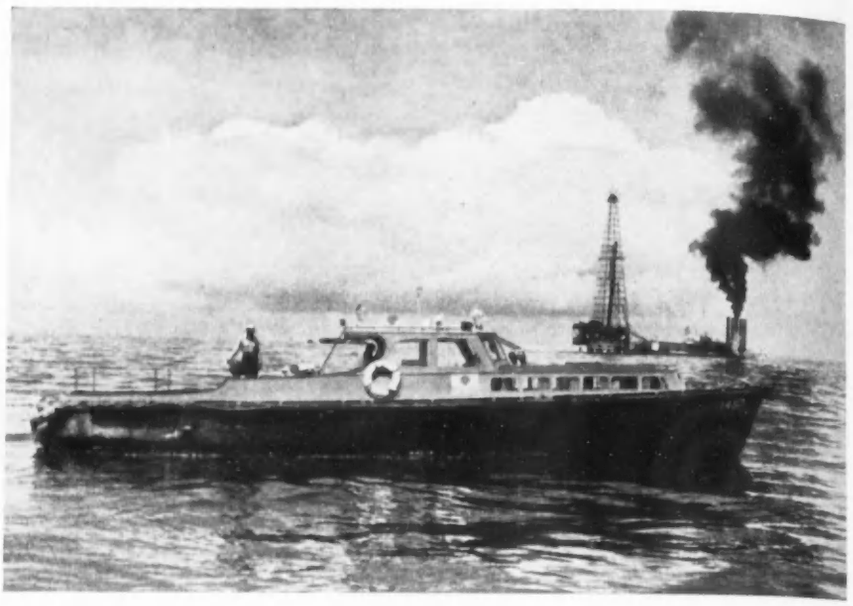
A sizable "navy"—from standpoint of numbers, the largest in South America and second largest in the Western Hemisphere—is required to transport men and equipment to drill new wells and to service existing producers, flow stations and underwater pipe lines in the offshore portion of the world's largest producing area. Transportation activities constitute a major undertaking for the three producing companies on the lake: Creole Petroleum Corporation, Compania Shell de Venezuela and Mene Grande Oil Company.

Similarly, U. S. producers will be involved with extensive water transportation operations as drilling and producing activities increase in tempo in the offshore areas in the Gulf of Mexico and along the Pacific Coast.

Boats and Barges. The movement of personnel in Lake Maracaibo requires from 1½ to 3½ hours round-trip daily on the water, and the average travel time is increasing as operations move farther offshore. Included in the transportation operation is a bus pickup of personnel at oil company camps and villages, moving the employes to docks and then over the water to their jobs. With the average travel time increasing, the Venezuelan oil companies are faced with sharply mounting costs since under union contracts travel time is paid at the rate of time and one-quarter.

Creole, Venezuela's largest oil producer and the biggest offshore operator in the lake, operates a fleet of 310 floating units which makes the company one of the largest boat owners in the world. More than 500 men working around the clock are required to man the fleet and incidental transportation activities to move personnel and supplies for the company's drilling and producing operations. An ad-

Lake operators need personnel launches, derrick barges and drilling barges . . .



Operating at top speed on Lake Maracaibo is personnel launch of Compania Shell de Venezuela. Boat can make between 17 and 20 miles per hour and takes 1 to 1½ hours to transport men to most distant rig in lake. Oil companies have to pay time and a quarter "travel" time for such employe movement.

Moving a derrick to a new location is a common sight on Lake Maracaibo.

Nine drilling barges are operated by Creole on Lake Maracaibo. This one is tied to a well platform. It can be moved away in event of rough weather on lake.

ditional 308 employes are assigned to boat repair and maintenance at Creole's La Salina boat yard.

The company's marine department with a central dispatching office located at Tia Juana transports approximately 400 men daily for producing and drilling operations, moves pipe and other equipment to rigs, supplies tugs to move workover barges, mud barges and cementing barges. The transportation operation requires precision timing to avoid costly delays in getting drilling crews and equipment to the proper location on time.

Creole's Lake Maracaibo fleet consist of 167 personnel launches of 32 and 50-foot length, 128 barges and workboats, including nine drilling barges and ranging in length from 85 to 200 feet, and 12 tugboats of 350 and 750 horsepower.

Helicopters and Hydrofoils. Mene Grande, whose lake concessions are located within a one kilometer strip (.62 mile) parallel to the shoreline, has to transport about 200 men each day to its offshore locations. The company uses a fleet of nine personnel launches of 35- and 46-foot lengths, 21 smaller boats and four war-surplus LCT's. The company's launches are used for towing operations and most of its boats are used in combination passenger and equipment-moving service.

Shell, which operates the land concessions in the Bolivar Coastal field, and whose offshore drilling operations commenced in the last few years, operates a smaller boat fleet. This company, however, is pioneering in experimental use of helicopters as a

faster method of moving both men and equipment to offshore locations.

The company recently placed a three-man helicopter in service from its Lagunillas camp to move supervisory personnel to its three drilling barges at wildcat and stepout locations approximately 18 miles offshore. Personnel boats operating at top speeds of 17 to 20 miles per hour require 1½ hours travel time each way to these more distant rigs and Shell currently is paying employes on these rigs travel time each day of 3½ hours.

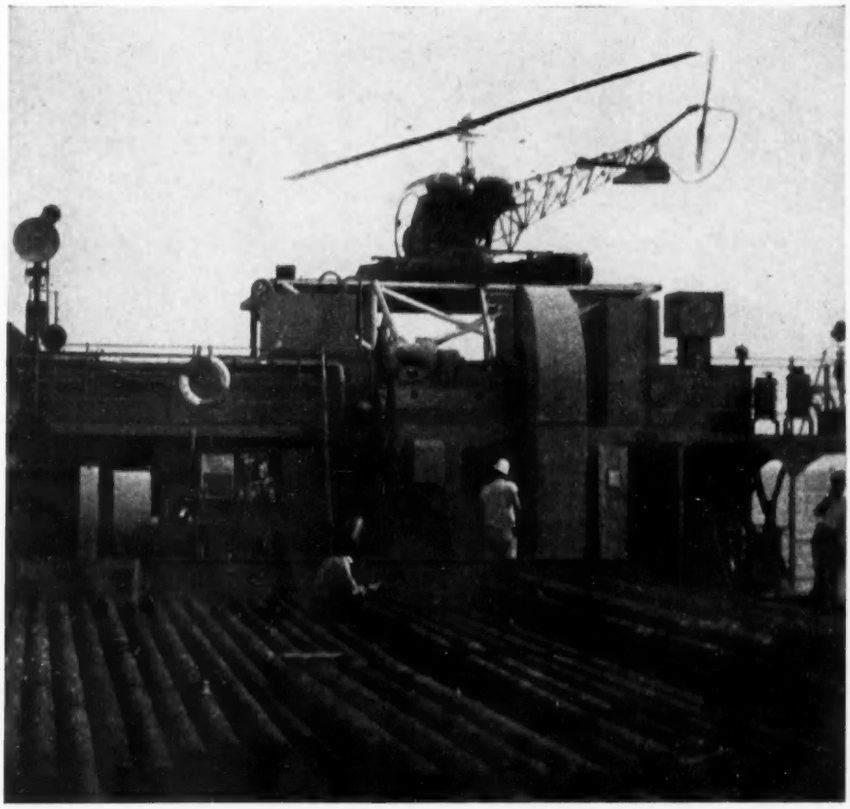
The small helicopter now being used by the company can cruise at 70 miles per hour and can make the run to the most distant rigs in 20 minutes. Cost studies are being made by all three lake companies on the possibilities of using helicopters to move both men and equipment to offshore locations. Under consideration are 10- and 20-men helicopters that would be operated for the oil companies by a contract helicopter service.

Shell has constructed steel landing platforms on two of its drilling barges for use by its small helicopter, which is equipped with pontoons for water landing, if necessary. Use of larger 'copters for personnel movement would require separate barges as offshore 'copter ports.

Also under consideration for use in moving personnel in Lake Maracaibo are fast "Hydrofoil" boats, capable of hauling 30 passengers at speeds up to 50 miles per hour. The fast boats, best described as self-propelled water skis, were perfected by Swiss and German engineers and have been in use in Europe.

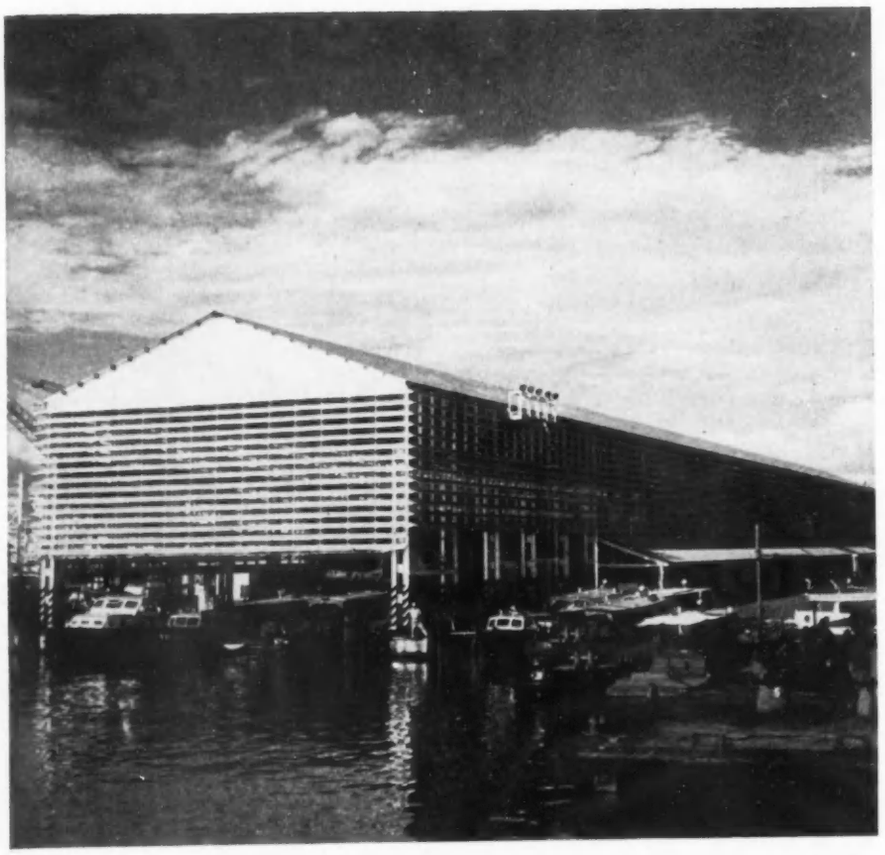
Corrosion and Toredos. While the transport of personnel and equipment on the lake is a costly operation, maintenance of the oil companies' floating equipment is an even costlier one. Experienced corrosion engineers say the maintenance of floating equipment on Lake Maracaibo is the most difficult of any body of water in the world due to the extremely corrosive chemical content of the water and the marine life present. The corrosive nature of the water—estimated to be ten times more corrosive than sea water—is at-

Three-man helicopter is being tried by Shell as a possible method of cutting travel time to offshore rigs. The 'copter shown here was placed in service recently to move supervisory personnel only. Its 70-mile-an-hour cruising speed can reduce travel time to the most distant rigs from the 1 to 1½ hours to 20 minutes.



Landing platforms such as the one above have been constructed on two of the Shell drilling barges. Landing platforms are made of steel. The 'copter is equipped with pontoons for a water landing if necessary.

Creole's Tia Juana Pier. The company's fleet of 310 lake units is dispatched from this central office.



Repair facilities for the Creole boats are maintained at La Salina. A repair crew of 308 maintains a total of 800 diesel engines and 2.8 million square feet of hull and deck area in the company's fleet.

tributable to the large number of streams that empty into the lake.

Lake Maracaibo has a low percentage of salinity (5 percent) and for that reason has few barnacles to attack boat hulls and pilings, but a serious problem is created by the marine borers, toredos, present in the water. These hardy creatures attack wooden and concrete pilings as well as plastic pipe and boat hulls. Gulf Coast operators will be faced with both barnacles and toredos on boats and offshore piles.

Steel boats are used in the lake fleet, but the oil companies have experimented with fibrous glass and plastic hulls in an attempt to find a hull that would withstand corrosion and toredos. So far only steel has proven impervious to toredo attacks, but, of course, subject to corrosion damage.

Various plastic paints have been tried on boat hulls for corrosion protection. But in most instances it has been difficult to obtain a proper bond on the metal. More recently, vinyl base paints have been tried and indications are that they could possibly be a solution to corrosion problems. Tests show that such paints can give boat hulls more than a year's protection, though much more experience under operating conditions will be required before engineers of the marine departments are convinced they will provide the needed solution.

Creole's boat repair facilities at La Salina consist of two graving docks, an outfitting pier and engine repair shops. The boat repair facilities are also equipped to make emergency repairs on large tankers. The company's maintenance program schedules small craft in the yard for inspection and overhaul once every six months. This includes engine overhaul and hull scraping and painting. The repair shop has 800 diesel engines and 2.8 million square feet of hull and deck area to maintain in the company's boat fleet.

A look at the boat yard's work sheets for 1953 shows that 4.2 million square feet of hull and deck areas were scraped and painted (an average of 1½ paint jobs for each unit) and that the average work handled in the shops amounted to 17 units per week during the year. —The End

What's Happening

AMONG WORLD OIL MEN

D. F. STEINKE has been named overseas training coordinator for Standard - Vacuum and will be located in Palembang, Sumatra. Formerly he was director of Power Education, Dow Chemical Company, in Midland, Mich. He will complete an extensive orientation program by August 1, at which time he will leave for Indonesia.

D. F. Steinke

•

BARTLEY E. CAMPBELL has been appointed manager accounting, Gulf Oil Corporation's Foreign Production division, New York, succeeding HERBERT J. LANDIS, who retired after nearly 44 years with Gulf.

Bartley E. Campbell

Campbell joined Gulf's New York office as an accountant in 1930. From 1938 to 1944 he served in Venezuela as a staff accountant with the Mene Grande Oil Company, a Gulf subsidiary. For the past 11 years he has been an assistant to Landis.

Landis joined Gulf in 1911 at Atlanta. After six years he was transferred to the Pittsburgh offices and in 1923 to the South American Gulf Oil Company in New York as assistant to the auditor for Gulf's foreign operations. In 1941 he was appointed auditor, and later was promoted to manager of accounting and assistant comptroller of the company's foreign operations in both hemispheres.

•

WALLACE M. LUTHY has joined Canadian Oil Companies, Ltd., at Calgary to organize the company's newly-formed Production department. Previously Luthy was crude oil supply manager of Ashland Oil and Refining Company.

L. F. McCOLLUM, president of Continental Oil Company, has recently returned from an inspection trip of Continental's exploration activities in Egypt. The company's subsidiary, Egyptian-American Oil Company, is drilling its first test well 28 miles southwest of Alexandria on a 50 million-acre concession granted by the Egyptian government last year to subsidiaries of Continental, The Ohio Oil Company, Cities Service Company and Richfield Oil Corp. for which group Egyptian-American is the operator.

•

JOHN W. PROCTOR of Calgary has been named general manager of the Canadian Petroleum Association. He has served CPA since January 1, 1955, as executive secretary of the Alberta division, after having served as general manager of Alberta Interfield Gas Lines, Ltd., from 1951 through 1954. He succeeds R. H. C. HARRISON, who resigned effective June 30 to accept an executive position with an oil company in Calgary.

Receives French Citation

Serge F. Scheer (left), president of Standard of New Jersey's French affiliate, Esso Standard S.A.F., has been awarded a second citation by the French government for his work in developing France's oil resources. Scheer recently was promoted from Chevalier to Officer of the French Legion of Honor. Here, Scheer and Eugene Holman, chairman of the board of Jersey Standard, are viewing contour maps of France's first major oil field—Parentis—located near Bordeaux.

EDWARD N. LEIBACHER has been elected a vice president of Standard-Vacuum Oil Company. Leibacher has 39 years of oil business experience, much of which has been concerned with refinery operations in Sumatra. He helped direct Stanvac's extensive Palembang refinery habilitation program after World War II and in 1947 was coordinator for Indonesian affairs for Stanvac in New York until his election to the company's board of directors in 1951.

E. N. Leibacher

•

CLYDE JOHNSON has been named vice president and manager of Delta Drilling Company's two Venezuelan subsidiaries, Perforaciones Delta C.A. and Perforaciones Guarico C.A. Johnson saw Venezuelan service with Loffland Brothers of Venezuela prior to accepting his new post.

Clyde Johnson

•

L. P. MAIER has retired as chairman of the board and as director of International Petroleum Co., Ltd., affiliate of Standard Oil Company (New Jersey). Maier's oil business career of almost 40 years included work in Mexico and Columbia. In 1945 he was elected president of International and in 1954 he was elected board chairman.

Also in Toronto, JOHN J. WAYBRIGHT has been elected to International's board of directors. Waybright's 20-year career has included work at Jersey Standard's Bayway and Everett refineries, the post of assistant refinery coordinator for Jersey Standard, and special assistant to the president of International on refining matters.

A camp family enjoys the lawn. Mrs. Robert E. Gulledge and daughters, Carol Ann, 11, (left) and Sheila, 8, play with the family pets.

This feature, one of a series describing important oil camps or cities throughout the world, is intended only to describe living conditions and to give a bit of the local atmosphere. While an occasional one of the features may touch lightly on working conditions, it will do so only incidentally.

Life in the Monte Is Mild

There is a lot to like at Las Mercedes camp, the largest Texas Company operation in Venezuela, as those who are there will confirm.

By JAMES JOSEPH

IT WAS FROG season at Camp Las Mercedes, and I'd been forewarned.

"Better pull back those sheets and take a gander 'fore climbin' into bed tonight . . ." It was E. E. (Tex) Chandler, Las Mercedes' transportation super who'd said it. And then he'd laughed.

"Little critters everywhere . . ." That from Joel Lozano, a University of Texas petroleum engineer from Harlingen, Texas.

Sure, I'd heard the story of the little frog and the voluptuous damsel. Who hadn't. But damsels had nothing whatever to do with Las Mercedes' wayward ranas. They cringed beneath beds, clung to walls, hopped along the shower's wet floor. Screens kept out everything else that wiggled, crawled or flew—except frogs.

Yet none of the 55 American families who call "Las Mercedes" home seemed to mind. They took the May through September frog invasion—which is also the rainy season—with a shrug.

Mrs. Irma Coinson said she had agreed to "try camp life for two years." That was eight years ago. Since then she's had two of her three children in the camp's hospital—and loves the semi-jungled monte which presses in from all sides.

What better recommendation, I thought, than a Manhattan girl living in a camp as isolated as Las Mercedes. For it's an hour's ride to the nearest airport—Valle de La Pascua (two planes daily), five to six hours by car to Caracas, which is ten air hours from Broadway, Mrs. Coinson's old stamping grounds.

There's a lot to like about Las Mercedes, biggest Texas Company (which

A pause for refreshment at Roblecito club.

Mike H. Bush (left), assistant to district superintendent, talks it over with W. L. Truscott, personnel head.

The camp hospital is big and modern.

Mrs. Giuseppi Venitucci (left), wife of camp's shop foreman, in camp supermarket. Above, two school teachers, Miss Leona Golbinec of Rossford, Ohio, and Miss Wilcox, in a discussion.

The camp pool is big and cool.

owns 50 percent of Sociedad Anonima Petrolera Las Mercedes) operation in Venezuela. A newcomer by Venezuelan camp standards (opened in 1944) and also small (but 250 staff camp residents), Las Mercedes is a well-kept, green-lawned town with a club, a nine-hole golf course, an assortment of cozy houses, waitered dining hall (for bachelors) and all the conveniences of stateside oil camps.

And, although all the maps label it "Las Mercedes," actually the camp's known locally as "Roblecito," to differentiate it from Las Mercedes, a nearby Venezuelan town.

An hour south from Caracas by plane, and you arrive at Valle de la Pascua's airport. Another hour over good, but unpaved roads, and the monte (part forest, part jungle, part dense overgrowth) becomes a clearing—which is Roblecito. There's the one-story white-washed administration building, the bachelor's dining hall and acres of lawn, planted here and there with houses—stucco bungalows, wooden cottages set on stilts, prefab metal homes. And on the very edge of camp, past the golf course (with its grass fairways, sand greens) and the school house, is the club—and its swimming pool.

The club, while it was built and furnished by the company, is run by the staff camp employes through an elected board. Food and drinks are sold slightly above cost and, when profits are realized, the club throws a free dinner or dance. Genial John Colgan, but six years out of Dublin, is the club's full-time manager, whose salary is paid by the club itself. John vacationed in Dublin recently, his first trip back.

The club, open until 10 p.m. weekdays, until midnight weekends, serves chocolate sodas for 30 cents, juicy hamburgers for 45 cents and mixed drinks tagged 60 cents. There are movies twice-weekly (60 cents for adults), two lanes for bowling (30 cents a line) and a growing library, its books carefully selected from *Time* Magazine's "current and choice" list.

Company-owned houses are rented to married staff employes at nominal rates, as well as a complete houseful of furniture, from gas range and electric refrigerator to springs and mattresses. If a family wants to eat "out," they can supper at the dining hall as often as five times monthly.

The company maintains a commissary store where all necessary food and household items are sold at prices lower than those which prevail in Venezuelan markets. There's homogenized milk (hauled from Caracas twice weekly in refrigerated trucks), frozen foods (flown in from Puerto la Cruz), fresh vegetables and meat. If a family hankers stateside bread, they can get it—for $1 a loaf (raisin bread: $1.20). Turkey runs $1.50 a pound, and a Thanksgiving bird weighing 15 pounds costs $22.50.

Married employes who are expatriated, mainly from the U. S., are paid a living allowance to cover the higher cost of living in Venezuela. Bachelors are housed and fed in company facilities.

On the Rio Aguaro, 80 miles due south of Roblecito, you can snag hard-fighting, good-eating *pavon* (a kind of small mouth bass) until your arms ache. Taking 50-100 fish a day, some weighing up to 13 pounds, is routine.

And, when you tire of that, there's terrific hunting: for duck, white winged dove, wild turkey (doesn't resemble the U. S. bird), jaguar, tapir, and lapa—a river-living rodent that dresses out to about 10 pounds and, according to some Roblecito-ites, "beats anything edible in the states." Lapa tastes like pure, sweet pork, sans fat.

Despite its long rainy season, Roblecito's climate is good, although humidity sometimes climbs to 100 percent, and temperatures hover year-around in the 80's. At rainy season's onset, every insect seems to burst simultaneously from cover; however, houses are screened and insects are controlled with the use of DDT and other insecticides.

Health is good and Roblecito's 40-bed hospital is free to staffers and available to their families at nominal rates including complete maternity care.

For youngsters, there's a neat, map-lined school, presided over by Miss Leona Golbinec (from Rossford, Ohio) and two other instructors. Thirty pupils attend the school's first through eighth grades (after that they go stateside) and a bus totes them to and from school. Actually, each child probably receives more attention at Roblecito's school than in the states. During 1953, there were eight pupils in the third grade, seven in first, and three in the eighth. Classes, which run from September through mid-June, are based on the Calvert System, a kind of correspondence instruction. School hours (five days weekly): 8:30-noon; 1 to 3.

If there are many prettier stateside homes than the Robert E. Gulledges',

they'd be hard to find. The Gulledges and their two children, Carol Ann, 11, and Sheila, 8, live in a two-bedroom stucco bungalow, its living room mahogany raftered. They have a spacious front yard, big backyard, and all the comforts of stateside (deep freezer, all kinds of electrical appliances—their own). And like most Roblecito families, Mrs. Gulledge keeps a maid.

Sunday school is taught by the mothers and ministered services are held once or twice a month when a Protestant clergyman comes out from Valle de la Pascua. Catholic services are held in the labor camp's school.

Roblecito begins work at 7 a.m. and continues until 4 p.m.; six days a week except for the office staff which works Saturdays 7 to noon. The Americans generally journey stateside every two years on paid leaves.

Roblecito's oil history is impressive. S. A. Petrolera Las Mercedes, jointly owned by The Texas Company and Caracas Petroleum Company (controlled by British interests), discovered the Mercedes field in central Guarico state in November, 1941. In 1946, two other fields were brought in: Palacio and Grico.

Roblecito camp lies dead center of the productive area, which extends about 60 miles east-west (from Grico to Dakoa) and 25 miles north to south (Valle to Belen). Currently produced are gas and oil, the gas piped to Caracas by Venezuela Atlantic Refining Company, and oil going via a 16-inch 157-mile line to Pamatacual, Mercedes' marine terminal east of Puerto la Cruz.

Golf course is kept in tip-top condition.

W. L. Truscott, Roblecito's personnel head (with wife, Jeannette, and four children), doesn't agree with "isolated" when it's applied to camp. True, he admits, there aren't any "close-by camps." But Mene Grande's San Tome lies but 160 miles over good road to the east. Booming Caracas is five hours north. And couples sometimes drive to Puerto la Cruz for the weekend—125 miles. Having a car is a definite advantage and most families do ("how else can you go fishing and hunting?").

Roblecito's labor camp softball nine has consistently slid home with Guarico state's championship (they once held it for three consecutive years). Par on Roblecito's links is 34—and Bill Lawrence, when he's hot, can usually chop around in less.

There's not what you'd call an "organized" sports program, although table tennis (very popular), tennis and bowling tourneys are annual events. Currently, the man to beat at the paddle-sport is J. A. Schilling, an accountant from Southern Methodist University, Dallas, Texas, who apparently learned more than debits and credits in college.

"He charms those pingpong balls," an admirer claims.

Roblecito—Las Mercedes if you insist—is a place of sunshine, quiet, grassy lawns and good times. And, as a Roblecito youngster gurgled, treading water in the club's big pool, "Gee, we kids like it here."

He could have added that his mother and dad felt the same way.

—The End

Homes are immaculate outside and in. This is interior of the Robert Gulledges' home.

Gas Fire at Pakistan Well Forces Work Suspension

Work at a deep test well being drilled by Pakistan Petroleum Limited at Haripur, East Pakistan, has been suspended after natural gas, which broke through to the surface around the well, caught fire.

When the well had been drilled to 7800 feet, evidence of gas was found, and 10¾-inch casing was cemented at 7727 feet. Three days later, gas pressure behind the casing began to increase, and then gas broke through to the surface in several craters around the well.

First, a crater about 200 yards from the well site caught fire and destroyed some camp buildings. After that fire died, another crater about 300 yards from the well began to blaze, and work was suspended.

While efforts were being made to control the fire, Pakistan Petroleum said its personnel had been evacuated to Sylhet town. The company said there were no casualties.

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Legends of Davey Crockett's bold pioneering exploits and his continual fight for a great country made him famous. Enardo pioneered the vapor control system in the oil industry, and today they are moving forward through advanced engineering to bring you even greater products. Insist on Enardo products for the best in modern equipment, backed by years of experience.
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Planning in Final Stages On Second Creole Plant

Creole Petroleum Corporation is in the final engineering stages of plans for construction of a second gas conservation plant on Lake Maracaibo in Venezuela. Preliminary research, completed in April, indicates that construction of another repressuring plant would result in recovery of substantial quantities of additional petroleum and conservation of large quantities of gas.

The project is expected to be completed early in 1957.

The new plant is designed to conserve nearly 120 percent more gas than Conservation Plant Tia Juana No. 1, inaugurated in January, and will cost approximately $36.5 million. To be known as Conservation Plant Tia Juana No. 2, it will be located six miles south of the plant now in operation.

The new installation will inject approximately 11 million cubic yards of gas into the Lake Maracaibo oil strata per day, materially increasing oil recovery from the reservoir and permitting the conservation of 74.5 million cubic yards of gas for future use.

Russian Oil Ministry Hoarding, Claims Pravda

Russia's Communist party newspaper Pravda has charged that many enterprises under the USSR Ministry of the Oil Industry are continuing to hoard large quantities of equipment badly needed elsewhere.

Cost of such hoarded supplies totals 233 million rubles, $58,250,000, the paper declared. Included are such items as 376,000 rubles worth of steel pipe which has been lying unused at the Ufa oil refinery since 1950, 25 power transformers which have been left at the Tuapse plant for many years, and more than 100 electric motors that have gone unused for a long time at the Grozny plant.

Richmond, Transwestern Seek Peruvian Permits

The Richmond Oil Company and Transwestern Peru S. A., are seeking exploration concessions totaling 33,570 acres in the Peruvian jungle region west of the Andes mountains in Amazon territory.

Richmond has requested rights on 25,967 acres, with Transwestern asking for the remainder.

Good Spot for DEPENDABLE equipment

Pure Oil Company has solved its material handling problems on this offshore drilling platform in the Gulf of Mexico with a Bucyrus-Erie 38-B crane. Equipped with a special 12-part boom hoist tackle and a 90-ft. boom, it handles all incoming and outgoing material and equipment — with the dependability desired on such an assignment.

When a well is completed, the 38-B loads all equipment directly into barges alongside the platform. A big derrick barge then moves the 38-B itself to another drilling platform.

On land or water, if your operation can use material handling and excavating dependability like this, get in touch with your Bucyrus-Erie distributor. He will give you complete facts on crawler or carrier-mounted lifting cranes, readily convertible to excavators from 3/8 to 4-cu. yd. 162E55

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1953 Australia Discovery Confirmed by New Test

While the recently-announced West Australian Petroleum Pty., Ltd., producer at Rough Range flowed at a rate of more than 1400 barrels daily on a four-hour drillstem test, a company spokesman said the initial rate could not be expected to continue on a longer test.

However, WAPET's new producer, which was the eighth well drilled after the 1953 Rough Range 1 discovery, did confirm the previous discovery.

The new producer, located 30 feet from the original discovery well, found oil at the 3605-3620-foot interval, and was drilled ahead to more than 14,000 feet in an effort to find deeper production. Since mechanical difficulties prevented completion in the producing zone after drilling ahead, the well was not producing.

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Engineered answers to oil well cementing

BJ SERVICE, INC.

New Mexican Producer Completed at Hidalgo

A well producing 3150 barrels daily of high quality light oil has been completed in Mexico's recently-discovered Miguel Hidalgo field in Tecolutla, Veracruz State. The well came in at a depth of 7730 feet.

Drilling has begun in the southern state of Chiapas in the vicinity of Ostuacan township. Antonio J. Bermudez, chief of Petroleos Mexicanos, the government oil monopoly, reports the first well had reached a depth of 500 feet.

North Italy, West Germany Gas Pipe Line Considered

Under consideration currently by Italian, West German and Austrian business circles is a pipe line from Italy's northern gas deposits to West Germany's highly-industrialized south. From Lombardy to Bavaria, the pipe line would cross Austrian territory in Tyrol province.

The basic plan under discussion calls for a pipe line from northern Italy to Bavaria via the Brenner Pass and Innsbruck, while a second line later would enter Austria in Carinthia province, cross Styria, Lower and Upper Austrian provinces to connect with a North Bavarian pipe line system.

While no detailed data were yet available, it was indicated that the pipe line cost would be amortized before exhaustion of the gas fields, which are expected to produce for 50 more years.

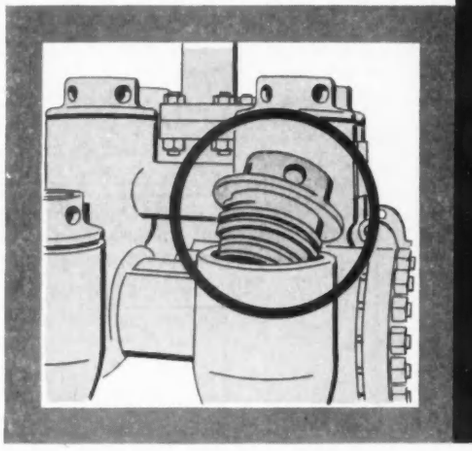
Upper Austrian Wildcat To Spud in This Month

Rohoel Gewinnungs Aktien Gesellschaft of Vienna, Austria, was scheduled to spud in its first well this month in the Upper Austria/Salzburg province border area around Puchkirchen. With drilling equipment from the U. S., the test is expected to reach 11,000 feet by late summer next year.

RAG and Austrian Institute of Geology geophysical experts reportedly are convinced that production will be discovered at 10,000-13,000 feet.

NEW EMSCO D-1000

provides the hydraulic power you need



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Emsco's new D-1000 will give you the high pressures and volumes you need for jet bit, big hole and deep drilling for present day operations.

The Emsco D-1000 is rugged and dependable, yet lightweight for its power rating. Fabriform construction of the power end utilizes steel plates and shapes in place of bulky, heavy iron castings. This permits easier, more economical transportation and rigging up.

Emsco D-1000 Power Slush Pumps are simple and easy to install, operate and maintain. There are no power end adjustments to be made — no greasing to be done, because the lubrication system is completely automatic. Emsco's patented "exposed" liner design eliminates all fluid washouts caused by liner packing failure, since the slightest leak may be detected and packing replaced before washout occurs.

There's an Emsco slush pump to meet every drilling requirement. Call your Emsco representative for details.

FOR MORE INFORMATION AT THE BOTTOM OF YOUR WELL

Double Shut-In Pressure Readings Provide More Information — In Less Time — Than Other Methods

"WHAT IS THE main advantage of double shut-in pressure readings?" That's a question often asked by those who have not yet tried this newest method of drill stem testing.

Actually there are *four* main advantages of the double shut-in pressure method:

1. Maximum formation pressure build-up in shortest time.
2. Comparison of reservoir build-up pressures before and after test.
3. Two separate chances to obtain reservoir pressure.
4. The measuring of the true equilibrium pressure prior to producing the formation provides a virgin pressure measurement and more accurate data.

Perfected by Johnston Testers, this new technique requires only a simple rearrangement of the test tool assembly. By placing a disc valve above the main or hydraulic valve, a specified volume of air is trapped between these two valves. This volume of air is called the "air chamber."

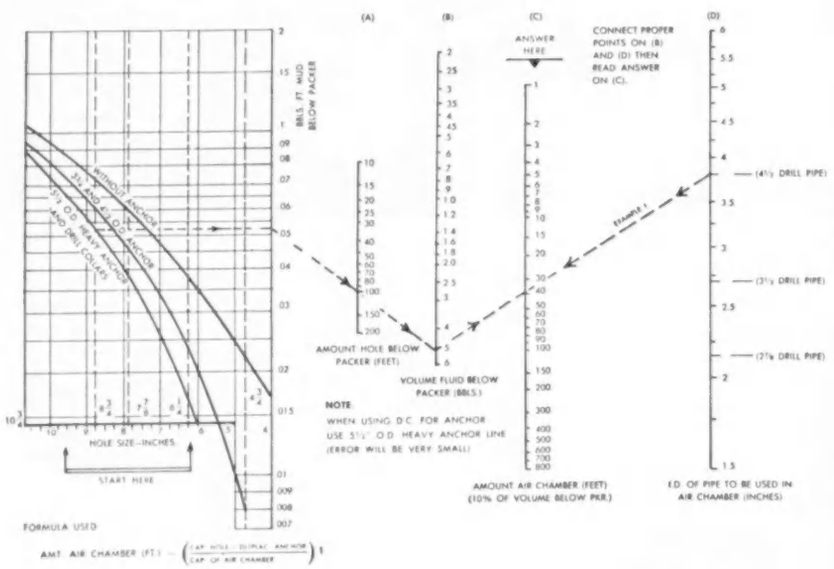
As the purpose of the air chamber is to relieve the mud pressure trapped below the packer, the secret of success of double shut-in testing is accurate use of this air chamber. Best results have been obtained when volume of the air chamber is about 10% of the volume of mud below the packer.

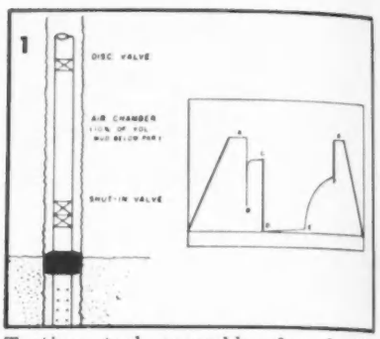
In the past, it has been common to calculate the air chamber to the nearest 30-foot pipe length. This lack of accuracy has often caused a failure to record the *maximum* initial shut-in pressure.

To overcome this problem, and to do away with complicated mathematics, Johnston has developed an "air chamber alignment chart." By simply drawing straight lines between known figures, the amount of air chamber needed can be calculated quickly and accurately.

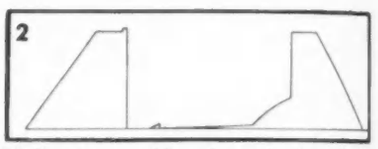
The chart below shows how simple it actually is to use this method.

Complete information on double shut-in testing is available from Johnston Testers, Houston, Texas. Write today for complete descriptive folder.

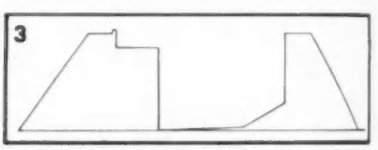

(A)
(B)
(C)
(D)
BBLS. FT. MUD BELOW PACKER
HOLE SIZE—INCHES
START HERE
AMOUNT HOLE BELOW PACKER (FEET)
VOLUME FLUID BELOW PACKER (BBLS.)
ANSWER HERE
CONNECT PROPER POINTS ON (B) AND (D) THEN READ ANSWER ON (C).
AMOUNT AIR CHAMBER (FEET) (10% OF VOLUME BELOW PKR.)
I.D. OF PIPE TO BE USED IN AIR CHAMBER (INCHES)
(4½ DRILL PIPE)
(3½ DRILL PIPE)
(2⅞ DRILL PIPE)
NOTE
WHEN USING D.C. FOR ANCHOR USE 5½" O.D. HEAVY ANCHOR LINE (ERROR WILL BE VERY SMALL)
FORMULA USED
AMT. AIR CHAMBER (FT.) = (CAP. HOLE − DUPLAC. ANCHOR / CAP. OF AIR CHAMBER) f



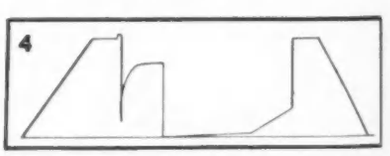
Testing tool assembly for double shut-in pressure readings which permits a limited fluid withdrawal. By placing the disc valve above the main or hydraulic valve so that a specified volume of air is trapped between these two valves.



Well not capable of producing fluid fast enough to fill up air chamber and cause pressure build-up.



Mud did not expand enough to get pressure draw-down below the formation pressure.



Mud expanded and pressure draw-down was below the formation pressure. Well was able to flow enough fluid to fill up air chamber and build-up shut-in pressure.

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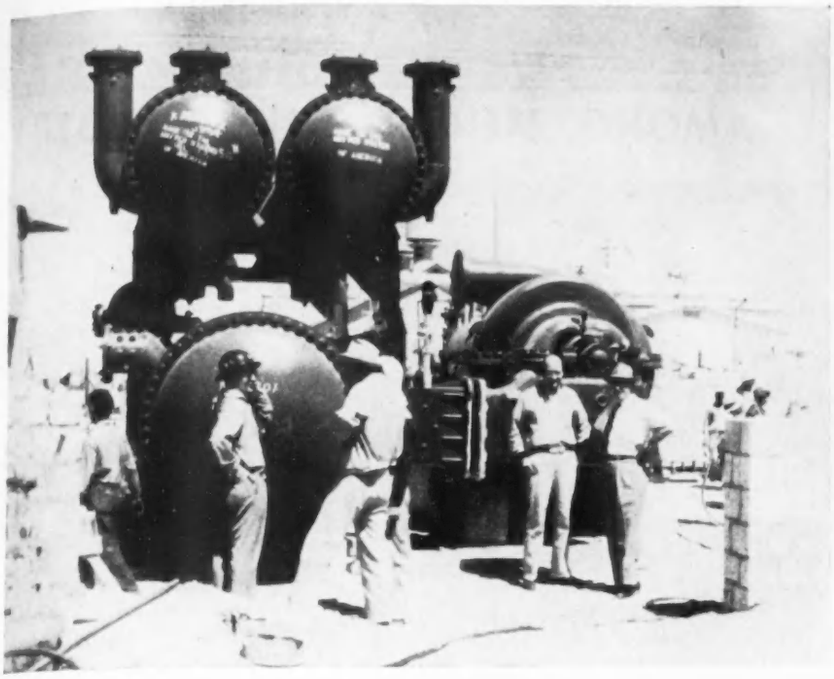

Arabian American Building from Inside Out

A building is being constructed around a refrigeration unit which will provide complete cooling facilities for buildings of Arabian American Oil Company at Dhahran, Saudi Arabia. The new unit will be driven by an 1103-horsepower turbine.

Austria Regains Control Of Captured Oil Fields

Through two agreements and at a cost of more than 80 million barrels of crude, representing a value of at least $200 million, Austria has resumed control of its oil fields which were captured during World War II.

One treaty—signed at Vienna by the U. S., Great Britain, France, and Russia—calls for Austria to deliver to Russia about 67,880,000 barrels of crude as war reparations during the next ten years. Too, it gives Russia exploration concessions, producing areas, refineries, and marketing installations.

The second pact—signed in Moscow between Russia and Austria—allows for the return to Austria of these enterprises, including 291 former German but presently Soviet-operated agencies, in exchange for $150 million. Part of the payment will be in oil shipments—2,036,400 barrels annually—to Russia.

In delivering 2,036,400 barrels within the annual $25 million value quota during the next six years, Austria will have to produce 8,824,400 barrels a year just to keep pace with the Soviet demands. In addition to this amount, at least 9.5 million barrels must be produced to satisfy domestic requirements. The annual production goal of 18.3 million barrels is believed in Vienna to be the greatest production that could be expected.

It appears that Austria might even be forced to import oil products to fulfill domestic requirements while shipping its crude to the east. At the same time, the Austrian refining capacity of about 12.8 million barrels a year would scarcely be utilized.

Carpathian Area Main Moscow Gas Supplier

Moscow is now receiving the greater part of its natural gas supply from the Carpathian Mountain area in the far western Ukraine.

The Soviet press reports that completion of the new pipe line extension from Kiev has enabled the Russian capital to push forward its plans for bringing gas service to all parts of the city. Formerly, a pipe line from Saratov on the Volga river provided most of Moscow's natural gas.

First part of the pipe line tapping the Carpathian gas field was completed in 1948 from Dashava eastward to Kiev, a distance of 300 miles. The extension from Kiev to Moscow is 510 miles long. It crosses the Dnieper and Desna rivers and supplies gas to the cities of Bryansk, Bezhitsa and Kaluga, in addition to smaller towns between Kiev and Moscow.

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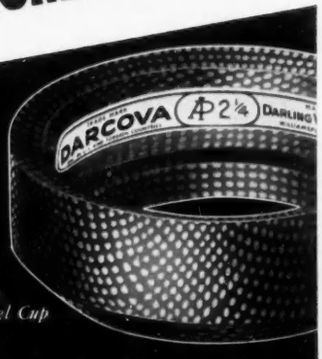

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(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

What's Happening

AMONG MEN IN THE INDUSTRY

W. L. Naylor

H. G. Meador

R. O. Rhoades

T. J. Sullivan

B. H. Barnes

Jerry McAfee

R. L. Boggs

B. B. Wescott

Gulf Oil Corporation directors recently elected four vice presidents and a new comptroller. Also, four other vice presidents were designated by the company as senior vice presidents. They, with the president and executive vice president, constitute a newly-created Management Committee which will assist the president and executive vice president in formulating objectives, policies, plans and programs and coordination of company activities. Senior vice presidents are **H. G. Meador,** formerly vice president, domestic marketing; **W. L. Naylor,** formerly vice president and comptroller; **R. O. Rhoades,** formerly vice president, production; and **T. J. Sullivan,** formerly vice president, manufacturing. The four new vice presidents elected are **B. H. Barnes** and **Dr. Jerry McAfee,** manufacturing; **R. L. Boggs,** production; and **Dr. B. B. Wescott,** research. The new comptroller is **F. B. Branson.** All are veteran employes of the company.

F. B. Branson

•

Raymond V. Cruce, formerly chief, Reserves group, Houston division, with Gulf Oil Corporation, has resigned to join the firm of **Robert W. Harrison & Co.,** consulting petroleum engineers and geologists in Houston.

•

Fred H. Carr, formerly district geologist for **The British-American Oil Producing Company** in Casper, Wyo., has been promoted to division geologist in the company's division exploration office at Denver. He has been with British-American in the Rocky Mountain area since 1949. Replacing Carr in Casper will be **Thomas W. Bibb,** former senior geologist in the Ardmore, Okla., district office.

•

Julian C. Ashby has been appointed general manager of **Utex Exploration Company, Inc.** He was formerly district geophysicist for Atlantic Refining Company.

•

Jack W. Knight has joined **Petroleum Research Corporation** at Denver as executive vice president and exploration manager. He was formerly division geologist for British American Oil Producing Company.

•

The Texas Company has announced the election of **James W. Foley** as executive vice president of the company. Elected a vice president in 1953, and a director in 1954, he is also a director of Arabian American Oil Company, the Trans Arabian Pipe Line Company, Texaco Exploration Company, Colombian Petroleum Company, South American Gulf Oil Company, Coltexo Corporation and the Texas Company (Iran). Foley joined The Texas Company in 1932.

•

James R. Arrington has been named manager of the Economics department of **The Carter Oil Company,** succeeding **G. D. Priestman.** Priestman, who has been head of the department for four years, will leave to accept a position with Standard Oil Company (New Jersey) in New York. He will head the Economics section of the Producing Coordination department. Arrington joined Carter as a roustabout at Otis, Kansas, in 1937. After serving as petroleum and research engineer, he became chief economist in 1951, and was named assistant manager of the Economics department in 1953.

Bell Oil and Gas Company of Tulsa has named **Herbert Rothstein** vice president. Rothstein, who joined the organization in 1939 as credit manager, has been secretary and assistant vice president. **Joel P. Dyer,** auditor of the company, will succeed Rothstein as secretary. With Bell since 1931, he is chief of the accounting section and office manager.

•

Roy B. Kelly, Washington, D. C., attorney, has been named president of **Toklan Oil Corporation.** He heads a group of investors who recently bought the interests of Curtis F. Bryan, Tulsa oil man and banker. **Cecil B. Hagen** was appointed consultant for the firm, and **Vaughn Bryan** and **James L. Ballard** were appointed vice presidents. New directors include Kelly, Ballard, **A. F. Childers, Jr., Wallace M. Davis, Jr., Holman Jenkins,** and **Richard R. Ohrstrom.**

•

John R. Suman, former vice president and director of Standard Oil Company (New Jersey), has been elected to the advisory committee of the board of directors of Chemical Corn Exchange Bank. Suman, who has established a consulting business in Houston since his recent retirement from Standard Oil, also will serve as special consultant to the Oil and Gas department of Chemical Corn Exchange Bank. Prior to serving with Standard Oil (NJ), he was vice president of the Rio Bravo Oil Company, and then vice president in charge of production and director of Humble Oil & Refining Company.

•

Arthur J. Feicht has been named president of **Kio Oil and Development Company.** He is also a director and member of the executive committee. He succeeds **John Bowers** who resigned as an officer and director after serving as president for two years. Feicht, Chicago insurance executive and investor, is a member of the Chicago Board of Trade, vice president of the Ballastran Corporation and president of Arthur J. Feicht and Company.

•

Buffalo Oil Company announces the following changes and additions in the Artesia, N. M., district office: **Ralph L. Gray** named district superintendent, replacing **H. G. Ellis,** retained as a vice president; **B. J. Hinson,** district engineer, transferred to the main office in Tulsa; and **Max E. Curry,** formerly with Skelly Oil Company, named to replace Hinson. **Vincent Foster** has joined Buffalo as petroleum engineer, working out of Artesia, and **Turner Wynn,** geologist, is being transferred to Artesia to be in charge of geological work in New Mexico and parts of West Texas.

•

J. F. Redmond, Shell Oil Company division production manager in Oklahoma City, has been transferred to New York as manager of exploitation engineering. He joined the company in 1936 as chemist in the Tulsa production laboratory. In 1943 he became senior exploitation engineer and in 1952 was appointed division production manager at Oklahoma City. **O. L. Nuernberger,** division production superintendent, has been made acting division production manager.

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The downright dependability of Continental Red Seal engines is one of the big reasons why you find so many Continental-powered units on location in all phases of oil field service. Operators have found that these truly specialized power plants deliver their full work quota year after year—many under the least favorable working conditions—at lower cost and with a minimum of down time. In production, in distribution, and in processing, Red Seals deliver extra satisfaction for the simple reason that they are engineered and built with the needs of specific applications in mind. The Red Seal industrial engine power range is a broad one, with models at closely-spaced levels—14 to 240 horsepower—and they're available for operation on all standard fuels. Each is the product of more than 50 years' engine-building experience—each with the in-built stamina to "stand up and take it" on the job year after year.

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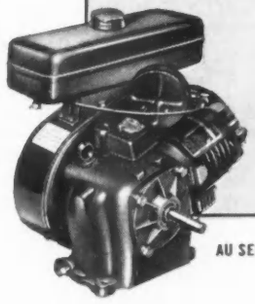
In addition to its large engines, Continental builds an outstanding line of heavy-duty air-cooled four-cycle models for industrial applications requiring 2 to 3 h.p. Advanced engineering gives them easy starting, high dependability, and unusual lugging capacity at low speeds . . . Options: patented and exclusive Contex® external ignition system, low-level ignition cut-off, 6-1 reduction gear, and other features. Available also for use on kerosene . . . For information on these models, address Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15, Mich.



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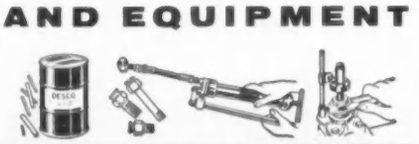

LUBRICANTS FITTINGS GUNS LUBRICATORS

Chester H. Lauck, known as Lum of the radio and motion picture team of Lum and Abner, has been appointed executive assistant, **Continental Oil Company,** with headquarters in Houston. Originally an Arkansas businessman, Lauck will work both in business and as an entertainer in Continental's coast-to-coast operations. His talents will be available to all departments for business meetings, civic and luncheon clubs, conventions, as an after-dinner speaker and for other community gatherings.

Chester H. Lauck

•

Reiter-Foster Oil Corporation has named **John H. Van Kirk** president and director; **Robert J. Farris,** vice president and treasurer; and **Joe H. Dawson,** vice president in charge of operations. Directors elected include **Jesse A. True, Alfons Landa, Henry Offerman, Harry D. Miller** and **August Russ-Openheim.** The Reiter-Foster Corporation was organized in 1924.

•

Warren K. Mankin, Jr., has joined the New Mexico Oil Conservation Commission at Santa Fe. He was formerly an engineer with The Texas Company at Fort Worth.

•

Armstrong A. Stambaugh, chairman of the board, has retired from active employment with **The Standard Oil Company (Ohio).** He will continue to be a member of the board of directors of Sohio and will serve in a consulting capacity. He joined the company in 1928 as manager of industrial and public relations. He became a director and sales vice president in 1933 and was elected Sohio's first senior vice president in January, 1950. He became the company's second chairman of the board in December, 1950.

A. A. Stambaugh

•

Kin-Ark Oil Company of El Dorado, Ark., has announced the election of **Richard C. Noel** as a director. Noel is a partner in Van Alstyne, Noel & Company and a member of the Board of Governors of the American Stock Exchange.

•

James R. Hatfield, Cities Service Oil Company, has been advanced to the newly-created post of technical adviser to the manager of production. **J. C. McClure** will succeed him as chief petroleum engineer for the division. McClure has been assistant division superintendent of production at Great Bend, Kansas. He will be succeeded by **James Porter, Jr. M. M. Hardin** of Madison, Kansas, is being transferred to Russell as district superintendent, and **R. L. Higginbottom,** production foreman at Russell, is being transferred to Madison as district superintendent. Hatfield has been with Cities Service since 1927. He was named assistant chief engineer in 1936 and chief petroleum engineer in 1945. McClure entered company service at Oklahoma City in 1937. He was appointed assistant division superintendent at Great Bend in 1953.

John A. Poulin has been named executive assistant to **E. L. Steiniger,** vice president **Sinclair Oil Corporation.** Poulin was formerly foreign production specialist, Oil and Gas division, Interior Department.

•

William A. Veitch has joined the **Wade Drilling Company** as representative in the Tulsa area. He was assistant manager for the Wofford Drilling Company three years before opening his own office in 1953.

•

H. Zinder & Associates, Inc., consultants to the utility and petroleum industries, has announced the appointment of **Earl Trager** as chief geologist. Doing geological work for a number of major oil comanies and governmental agencies since 1917, Trager was senior geologist with the Federal Power Commission before joining Zinder's Geological department.

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B. B. Jennings

A. L. Nickerson

A. T. Foster

Paul V. Keyser

Socony Mobil Oil Company, Inc., has elected a new board chairman, president and two directors. **B. Brewster Jennings,** president since 1944, was made chairman of the board of directors of the company to succeed George V. Holton, who retired July 1. **Albert L. Nickerson,** vice president and director in charge of foreign trade, was chosen president, succeeding Jennings. **Austin T. Foster** and **Paul V. Keyser, Jr.,** were elected directors. Jennings, who has been a director of Socony Mobil since 1939, will remain chief executive officer of the company by continuing as chairman of its executive committee. He has been with the organization since 1920. Nickerson joined the company as a service station attendant in 1933. In 1945 he went to London as chairman of the Vacuum Oil Company, Ltd., a wholly-owned affiliate, to return to the U. S. the following year as director of the parent company. In 1951 he was elected vice president and took over foreign trade operations. Foster has been general counsel of Socony Mobil since 1948. He joined the company in 1928 after experience with a banking house and a law firm. Keyser, with the company since 1930, becomes a vice president and director in charge of foreign trade, succeeding Nickerson.

•

Riley S. Smith, Jr., former professor of geology at the University of Tulsa, has joined the **Frost Geophysical Corporation** as Arizona project geologist. While at the University, he specialized in uranium geology, sedimentation and mineralogy. He did his University of Arizona doctorate field work on Triassic rocks of northeastern Arizona. **Floyd E. Klossing, Jr.,** will assist Smith in the field studies.

•

J. C. Thompson has retired from Pan-Am Southern Corporation and will establish an independent geological consulting office in El Dorado, Ark. He has been engaged in geological work with Pan-Am Southern and its predecessor, Root Petroleum Company, since 1928. He joined Pure Oil Company in 1924 and served in Oklahoma before he was assigned as district geologist in Arkansas. He became affiliated with the Root Company as chief geologist during the early stages of exploration activities.

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SEE the TREND of TOMORROW

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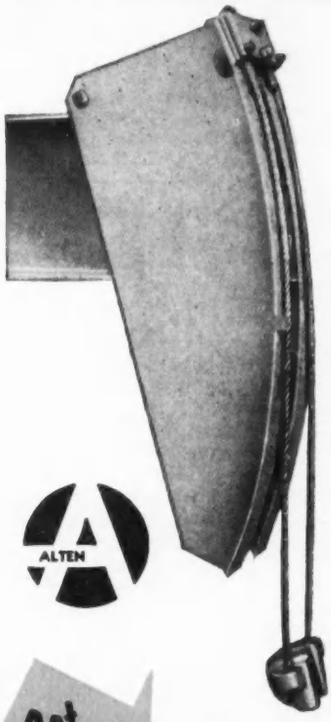

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NOW — A pumping unit with so many incredible features that it is years ahead of the field.

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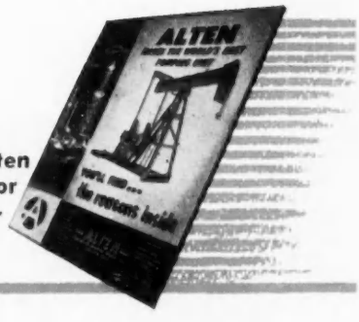

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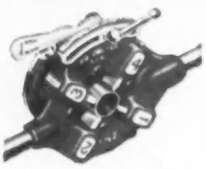
DESIGNERS & BUILDERS OF EQUIPMENT SINCE 1889

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)



No. 504... easy to set-up... fast to use . . . precision made...gives perfect threads every time.

No. 4P geared die stock gives perfect threads on 2½" to 4" pipe with four sets (5 each) of dies.

No. 65R for perfect threading by hand or with power . . . for use on 1" to 2" pipe . . . jam-proof . . . kicks out automatically when standard length thread is cut.

Small Ratchet threaders capacity from ⅛"-2".

RIGID PIPE THREADERS

Today, the craftsman is demanding more from the tools he uses. He buys tools based on performance...accuracy...dependability...and long service life. That's why RIGID Tools are number *ONE* in demand. They are designed and produced by men who have experience . . . who have devoted their lives to the manufacture of the finest line of pipe tools available.

SPECIFY THE RIGID "502" . . .

for use on any power drive. Single set of self-contained dies adjusts quickly to ½" and ¾" pipe ...regardless of position of quick opening lever.

SPECIFY THE RIGID "504" . . .

for use on any power drive. One set of full width dies adjusts to 1", 1¼", 1½" or 2". Quick-opening dies retract immediately while power drive is operating . . . eliminates slow back-off. Four-jaw work-holder sets to size instantly . . . no lead screw jam.

RIGID
WORK-SAVER PIPE TOOLS

MANUFACTURED BY THE RIDGE TOOL COMPANY • 540 Clark Street, Elyria, Ohio

DEATHS

W. W. (Web) Wilson, founder and chairman of the board of Web Wilson Oil Tools, Inc., died in Los Angeles July 3.

Harold Lee Corbett, 59, president of the Corbett Drilling Company, died June 10. He was in partnership with A. M. Barbour, Sr., in the Corbett-Barbour Drilling Company from 1919 until 1948 when he organized Corbett Drilling Company, operating extensively in the Mid-Continent area and Texas.

Vaughn Walter Russom, 63, died recently at McAlester, Okla. A geologist for Sinclair Oil & Gas Company, he was known for his extensive surface geological work in the Mid-Continent, Rocky Mountain and Williston Basin areas.

William Albert Stephens, 85, died recently in Overton, Texas. He began work in a West Virginia oil field in 1900. He also worked in the Warren, Ind., Kieffer and Avant, Okla., fields before being retired as foreman for the Prairie Oil and Gas Company in 1932.

Edward W. Johnson, 44, manager of process pump sales for the Oil Well Supply division of U. S. Steel Corporation, died June 20 in Dallas. He had previously been with Gulf Oil Corporation, The Texas Company and National Transit Pump Company.

Delmar Richard Guinn, 53, Cities Service Oil Company, died June 22 in Bartlesville, Okla. He was development geologist for the company.

D. E. (Gene) Kervin, 64, retired partner in the M. J. Delaney Company, drilling contractors, died June 24 in Dallas.

Dr. Rufus E. Zimmerman, 68, died in Summit, N. J. He was retired vice president and chairman of the research policy committee of U. S. Steel Corporation.

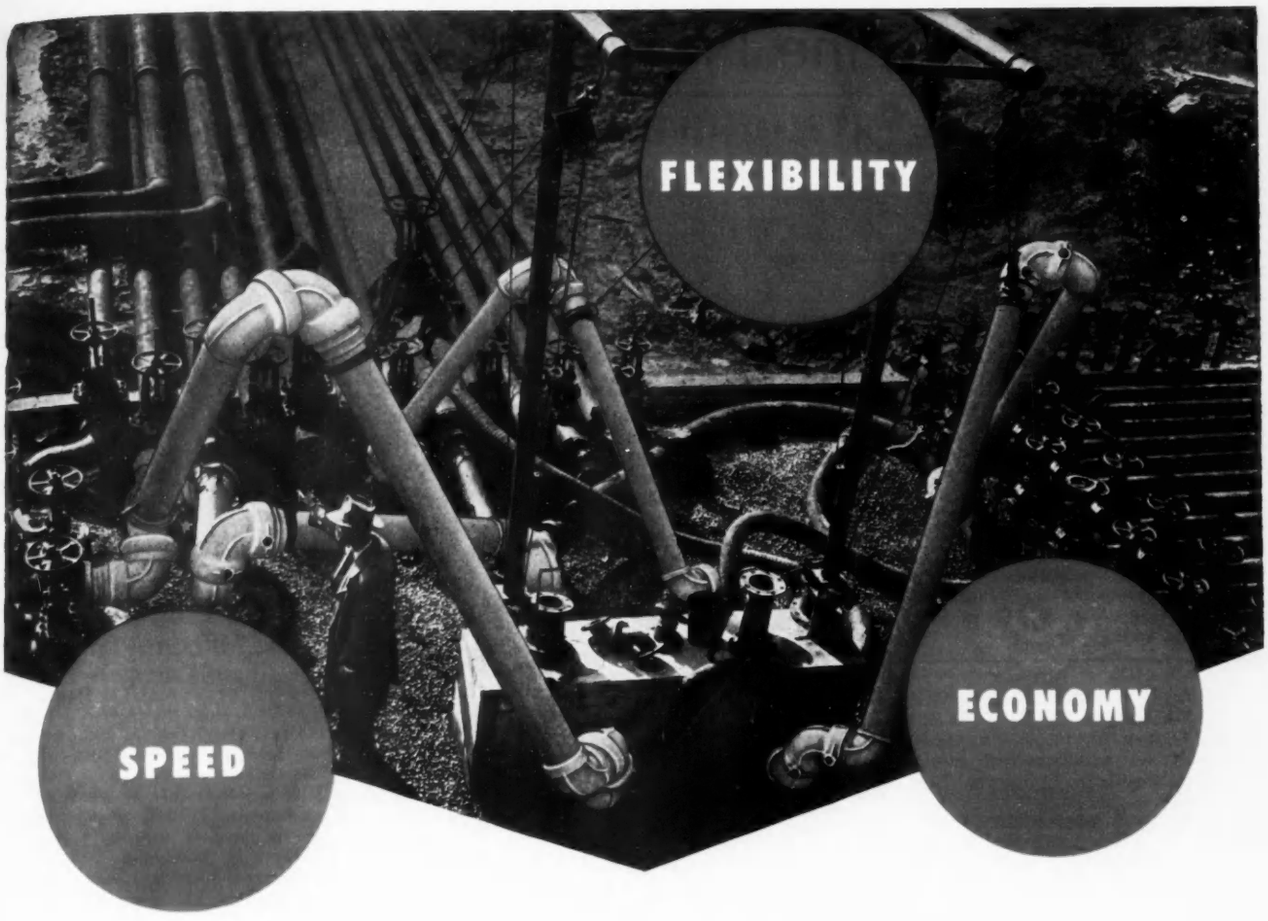
A. B. Vaughn, Bay City Drilling Company, died recently in Bay City. He was president of the company.

Howard R. Huston, 62, retired vice president and director of American Cyanamid Company, died June 8 in Truro, Mass. He joined Cyanamid in 1930 as assistant to the president. He retired in May of this year and has been serving the company as a consultant.

Glenn Livingston Greene, 80, retired oil production superintendent died June 17 in Tulsa. A pioneer Oklahoman, he was production superintendent for the Sinclair Oil Company, Ideal Royalty Company and Riverland Oil Company prior to retiring in 1932.

Harry L. Moat, 58, director of production for Atlas Powder Company Explosives department, died June 12 in Wilmington, Del. He joined the company in 1918.

Earl J. Robishaw, 44, vice president of A-1 Bit and Tool Company, died in Houston. He was with the company 18 years. Previously with The Texas Company, he was a charter member of the Nomads.



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Original cost of CHIKSAN flexible line manifolding installations often run as much as 50% less than fixed line manifolding operations which incorporate costly multiple valve and line systems.

A CHIKSAN manifolding operation is simplified in its entirety—providing complete flexibility, mobility and ease of operation in limited spaces.

CHIKSAN manifolding installations reduce line hook-up time—keep pit floor clear of lines thereby providing greater working areas.

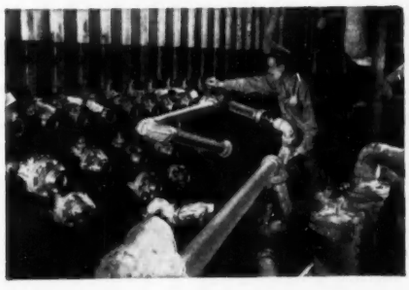
CHIKSAN manifolding operations facilitate the transfer of all types of fluids safely and rapidly under extreme climatic conditions with no possibility of cross contamination.

CHIKSAN manifolding installations are specifically engineered for long life—easy and economical maintenance, and render years of trouble-free operation.

Our Engineering Research and Development Department will welcome inquiries on your manifolding problems.

Write for Catalog G-4
Dept. 68

CHIKSAN Swivel Joints illustrated in this installation, facilitate the speedy, economical handling of various fluids through 16 lines from loading dock to manifolding pit — a distance of 800 feet. Since each line leads to a separate tank through the manifold, cross contamination is eliminated.



CHIKSAN Swivel Joints in the pump manifold above enable operator to pull base stock from outside storage into the plant and direct flow to proper vessel or proportioner.

The Flow of Enterprise Relies on

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Ball-Bearing Swivel Joints

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 3, Illinois • Newark 2, New Jersey
Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N. J.

Companies in the News

DRILLING AND EXPLORATION COMPANY OF DELAWARE, INC., has established a new Southeastern division, with headquarters at Monroe, La. **H. D. Pyke** has been named division manager. Replacing Pyke as manager of the Southwestern division at Midland is **Horace P. Goodrich.** Other personnel changes include **David A. Carnahan,** formerly with Emsco, named chief engineer at Los Angeles; **O. G. Barton** transferred from California to Monroe as drilling superintendent, and **H. J. Stewart** transferred from Los Angeles to The Hague, Holland, as assistant to **M. R. Garrison,** manager of Drilvo, Drilexco's European Dutch subsidiary.

Editors of WORLD OIL have been privileged to see the advance proofs of a Cities Service Company campaign which will appear in WORLD OIL and other publications. Carrying out the theme "Going Places" the coming campaign with Cities Service is a most striking one.

ILLINOIS WYOMING OIL COMPANY and **CANADA SOUTHERN OILS, INC.,** both of Casper, Wyo., have merged. Both companies are wholly-owned subsidiaries of Canada Southern Petroleum, Ltd. Illinois Wyoming, an Illinois corporation organized in 1948, was acquired by Canada Southern in 1952. Since that time it has continued to operate under the name of Illinois Wyoming Oil Company and has expanded its operations throughout Wyoming. Additional production also was obtained in the South Glenrock area of Converse County, Wyoming.

•

O K & B DRILLING COMPANY has been formed in Oklahoma City. The firm is composed of **Tom Ockershauser,** petroleum engineer; **Fritz Kate,** geologist, and **Loyd Benefield,** attorney and independent operator. **Tommie Gipson,** formerly with Calvert Drilling, is toolpusher.

TENNESSEE GAS TRANSMISSION COMPANY recently completed purchase of the major portion of the assets of Bay Petroleum Corporation of Denver and the personal oil holdings of its former president, C. U. Bay. Purchase price for both properties approximated $20 million. Operation of the oil and gas properties as an integral part of the TGT Production division will be under supervision of **R. C. Graham,** senior vice president. Two refineries, one at Denver and the other at New Orleans, and the petroleum products marketing facilities of the former Bay Petroleum will be operated by a newly-constituted Bay Petroleum Corporation. The new company is a wholly-owned subsidiary of Tennessee Gas and will maintain offices in Denver. **Gardiner Symonds** is board chairman and **R. R. Dean** is president of the new subsidiary company. Other officers include **Charles O. Garbrecht,** vice president; **C. C. Johnson,** vice president and treasurer; **Leo L. Leabo,** vice president and **J. E. Ivins,** secretary. Other directors include **Ardon B. Judd,** Dean, Graham, **J. J. King,** Garbrecht and Leabo. Except for Bay, officers and key employes of the former Bay Petroleum will continue with Tennessee Gas.

•

TRANS-TEX DRILLING COMPANY will move its offices from Longview, Texas, to Shreveport, La. A wholly-owned subsidiary of the Husky Oil Company, the company plans to expand its drilling into Oklahoma.

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D. D. FELDMAN OIL AND GAS, planning exploration in Europe and the Middle East, has opened an office in Paris, France, at No. 6 Avenue Franklin-Roosevelt. **Roger Henquet,** formerly head of his own organization in Paris, the Societe d'Etudes Petrolieres, will head the Feldman office. Henquet was formerly executive vice president and general manager of Schlumerger and, later, manager of European and Middle Eastern operations for The Superior Oil Company.

Consulting Firm Moves Calgary Offices

Alex W. McCoy Associates Inc., Tulsa oil consulting and management firm, has moved its Calgary, Alberta, Canada, division offices to new quarters at 701 Bramlett Building. Personnel of the Calgary office are, front, left to right: E. J. Baltrusaitis, vice president; A. W. McCoy, president, and John M. Andrichuk, staff geologist. Back, left to right, A. J. Beveridge, Ralph W. Edie, John Nisco, Ronald Johnson and T. P. Storey. Not shown in the picture are Donald A. Bird, draftsman, and Margaret R. Rorich, secretary. Other division offices of the firm are located in Denver and Casper, Wyo.

Celebrates Millionth Barrel

Heading a delegation of company officials, Clyde T. Foster, president of The Standard Oil Company of Ohio, mans the controls in celebration of the recovery of the one millionth barrel of oil from Sohio's Howard A-1 discovery well in the Eola field in Garvin County, Okla. The well was started November 26, 1945, and was completed January 23, 1947. Many of the men responsible for the Eola discovery were present including Frank H. Willibrand, Mid-Continent division manager of Sohio, and some of the drillers and roughnecks who are still working on Sohio rigs in the Eola pool.

CONTINENTAL OIL COMPANY has established a New Mexico production division, with headquarters at Roswell. The area formerly was a part of Conoco's West Texas-New Mexico division headquartered at Midland. **R. L. Adams,** assistant division superintendent at Midland, has been promoted to division superintendent of the new New Mexico division. Adams joined Conoco in 1946 as a roustabout in New Mexico. Before his promotion to assistant division superintendent at Midland in 1954, he served briefly as superintendent of Conoco's North Oklahoma production district. Two district production offices have been established at Glenrock and Linch, Wyo. The Eastern Wyoming district at Glenrock will be under the direction of **R. C. Bartels,** and the Central Wyoming office at Linch will be under **William C. Blackburn.**

•

MECOM PETROLEUMS, a limited partnership operating in the Gulf of Mexico and south Louisiana, has been formed by San Jacinto Petroleum Corporation and John W. Mecom. Offices will be maintained in New Orleans and Houston with Mecom, as general partner, serving as operator of the partnership properties. B. G. Martin is president of San Jacinto.

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McRAE OIL AND GAS CORPORATION, which recently purchased the stock of Intercoast Petroleum Company, Inc. of Midland, Texas, will maintain the Midland office as headquarters for activities in West Texas. Intercoast, a producing oil company, has wells in West Texas and New Mexico.

What's Happening

AMONG INDUSTRY ASSOCIATIONS

Desk and Derrick Plans Convention in New York

"Extended Horizons" will be the convention theme of the Association of Desk and Derrick Clubs of North America at its fourth annual meeting in New York September 2-3. The theme coincides with the Association's purpose of promoting exchange of knowledge and understanding of the oil industry among the women employed in it.

Some 2000 members of the 98 regional clubs which make up the Association are expected to attend the meeting.

Field Trip in Black Hills Planned by Dakota Group

The Cretaceous to Pre-Cambrian stratigraphy in the vicinity of Rapid City and the southern Black Hills will be highlighted during the North Dakota Geological Society's field conference September 14-17. Tours through the uranium mining area at Edgemont and active mines nearby also will be included.

Rocky Mountain Association Elects Healy President

Harold H. Healy of Casper has taken office as president of the Rocky Mountain Oil and Gas Association. Succeeding W. W. Flenniken of Denver, he will serve as president of RMOGA for the next year.

Healy, an attorney and independent oil operator, is a former division manager of the Ohio Oil Company. RMOGA is a trade association of the oil industry in Colorado, Nebraska, Wyoming, Utah, Idaho, South Dakota and Montana. Headquarters are in Casper. Divisional offices are located at Denver and Billings.

TIPRO Official Resigns, To Be Succeeded by Turner

E. I. Thompson, one of the organizers of the Texas Independent Producers and Royalty Owners Association, has resigned as executive secretary of the organization. W. Earl Turner, publicity director of TIPRO, will succeed him. Thompson will remain as advisor to the president.

Larrabee, Greco and Battle Named to NACE Committees

C. P. Larrabee, Applied Research Laboratory, United States Steel Corporation, has been named chairman of the Technical Practices Committee of the National Association of Corrosion Engineers. E. P. Greco, senior research chemist, Research department, United Gas Corporation, has been named vice chairman. Larrabee succeeds H. W. Schmidt, The Dow Chemical Company, who has been chairman for the past two years.

The Technical Practices Committee is composed of the chairman of the six major subdivisions of the association's technical committees plus the chairman, vice chairman and W. F. Fair, Jr., The Koppers Company, vice president of NACE.

The Technical Practices Committee acts on policy matters and generally supervises technical committee activities of the association.

Jack L. Battle, Humble Oil & Refining Company, has been elected vice chairman of Technical Group Committee T-1 on corrosion in oil and gas well equipment. Supervising chemical engineer in the Production department of Humble, Battle also is chairman of T-1H on oil string casing corrosion, one of the 13 subdivisions of T-1.

Bunnye Lerner to Supervise Women's Program of OIIC

Bunnye Lerner has been appointed supervisor of the women's program for the Oil Industry Information Committee in New York. She succeeds Marceline Marquis.

Bunnye Lerner

Lerner, administrative assistant in the Denver OIIC office, has been with the group since 1951, starting as a stenographer.

In her new job, she will be in charge of the women's activities sponsored by the OIIC, the industry's nation-wide public relations program.

Houston Drilling Contractors Name McDannald President

Morris McDannald, Mac Drilling Company, has been elected president of the Houston Chapter of the American Association of Oilwell Drilling Contractors. He succeeds Harry J. Chavanne, Prince Drilling Company.

C. B. Webster, C. B. Webster Drilling Company, was elected vice president; and M. C. Clegg, Clegg & Hunt, was elected secretary.

First PE Graduate Honored

Frederick Arthur Johnson, right, receives a memorial certificate on the fortieth anniversary of his graduation from the University of Pittsburgh's Petroleum Engineering department in 1915, at which time he became the first man to receive the degree of petroleum engineer. Presentation was made during the annual meeting of the Pennsylvania Grade Crude Oil Association by Professor H. G. Botset, head of the Department of Petroleum Engineering in Pitt's Schools of Engineering and Mines.

API Division Begins Tanker Corrosion Study

F. M. Watkins, of Sinclair Research Laboratories, Inc., has been retained by the Division of Transportation of the American Petroleum Institute to coordinate research on tanker corrosion problems. Working with the API Central Committee on Transportation by Water, Watkins will coordinate the research being done by various companies.

To direct the program calling for both laboratory and shipboard testing as well as coordination of company research programs, a Tanker Corrosion Research Committee has been formed with H. G. Schad, vice president of the Atlantic Refining Company, as chairman. Membership is divided between marine and research departments of companies operating tankers.

A Tanker Corrosion Program Committee, headed by F. W. Miller, of Esso Shipping Company, has been formed, also, to work with the coordinator on implementation of the programs approved by the Tanker Corrosion Research Committee.

Canadian Geologists Plan Fall Meeting, Field Trip

Jurassic and Carboniferous systems in Alberta and adjacent areas will be the theme of the American Association of Petroleum Geologists Western Canada regional meeting and the Alberta Society of Petroleum Geologists fifth annual field conference September 14-17 at Jasper National Park, Alberta. The field trip September 17 will consist of a series of stops en route from Yellowhead-Pocohontas to Miette Hot Springs where a stratigraphic succession ranging from Lower Cambrian to Lower Cretaceous age can be examined. Technical meetings are scheduled to begin September 15. Informal geological discussions will be held each evening to review papers presented during the day.

NACE Section Organized At Casper, Wyoming

Louis T. Krueger, Northern Utilities Company, has been named temporary chairman of a section of the National Association of Corrosion Engineers being organized at Casper, Wyo. The section will be the forty-ninth local organization of NACE and the first in Wyoming.

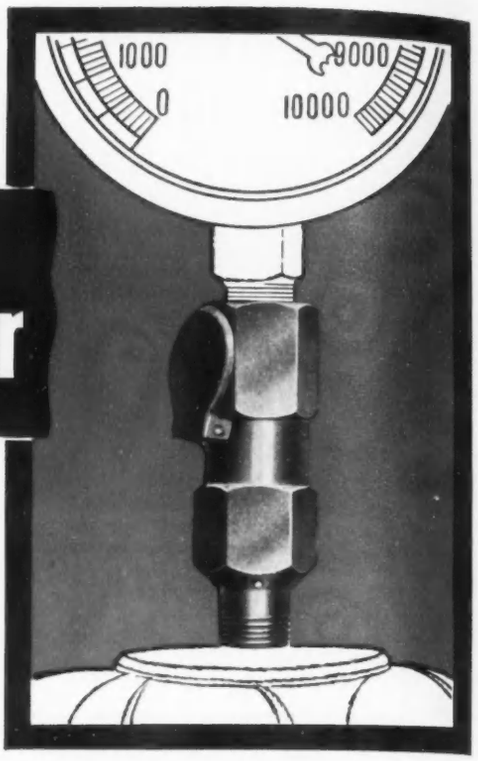
Four Succeed to Posts On API Board of Directors

Four members recently elected to the board of directors of the American Petroleum Institute include E. H. McCollough, Amerada Petroleum Corporation, succeeding E. A. Landreth of Fort Worth; Thomas E. Sunderland, Standard Oil Company (Indiana), succeeding A. W. Peake of the same firm; and J. E. Roth, Tide Water Associated Oil Company, succeeding E. H. Salrin, also of Tide Water. Landreth, Peake and Salrin recently resigned. John F. Daley, Organic Chemical department, The Du Pont Company, has been named to succeed the late Ray E. Miller of that company.

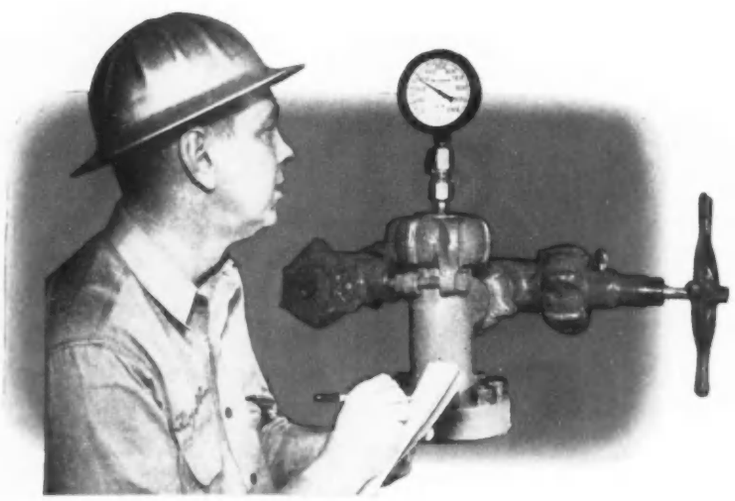
Announcing

THE THORNHILL-CRAVER

Gauge Valve-Connector



Patented — U. S. Patent No. 2618978



- ***Saves Investment In And Maintenance of Christmas Tree Gauges.***
- ***Provides More Accurate Pressure Readings.***
- ***Increases Safety.***

The Gauge Valve and Connector is designed to take the place of permanently installed Christmas tree gauges, providing instead a safe, easy, and inexpensive means of obtaining pressure readings with a single master gauge. Thus, no gauges are left on the tree. All danger of breakage and constant exposure to the elements is eliminated. The investment in gauges is reduced to a single unit, and gauge maintenance is reduced proportionately. Utilizing a single master gauge for all wells on a lease assures uniform, accurate pressure readings.

The Gauge Valve and Connector consists of two stainless steel units: the upper, or connector element, which connects to the master gauge, and the lower, or valve element, which is installed permanently on the Christmas tree.

To obtain a pressure reading, the operator simply inserts the upper element, with master gauge, into the lower element, as illustrated at left. Rotation of the upper element ⅓-turn engages a J-slot and automatically opens the valve in the lower element, exposing the gauge to well pressure. Disengaging the J connection allows well pressure to automatically close the valve. For pressures of less than 500 lbs., a spring-actuated valve is available.

THORNHILL UNIBOLT **CRAVER CO.**

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What's Happening

AMONG SERVICE AND SUPPLY MEN

Robert C. Andrews

Karl A. Roesch

Edred J. Pannell

William J. Davies

C. H. Hickman

G. L. Huestis

Leonard Spray

Vaughn A. Euge

William R. Budd

Claude E. Davis

W. H. Masterson

H. L. Arrowood

Robert C. Andrews, appointed sales manager for **Clark Equipment Company's** Axle division, will be responsible for the supervision of sales activities, including staff and dealer organization. Andrews was with Vickers, Inc. 15 years in production, sales and sales coordinating engineering.

The White Motor Company has announced the appointment of **Karl A. Roesch,** director of service, as general manager of the company's Autocar division. Roesch succeeds **Edward F. Coogan** who is retiring after 31 years of continuous service with Autocar and 50 years with the automotive industry. Roesch joined White Motor in 1928. He was named assistant to the vice president in charge of sales in 1953 and director of service in 1954.

Edred J. Pannell, recently appointed to the newly-created position of manager of oil and gas industry sales for **Owens-Corning Fiberglas Corporation,** has been with the company nine years. He will be dealing principally with anti-corrosion products in his new position and will have divisional responsibilities for pipe wrap sales in 37 states east of the Rocky Mountains. He formerly handled general Fiberglas products and textiles for the Oklahoma territory out of the Tulsa branch office.

William J. Davies will succeed **Robert J. Laidlaw** as district manager of **Worthington Corporation's** Cleveland office. Davies joined Worthington's Harrison Works in 1937 as a sales trainee. From 1938 to 1942 he served as application and sales engineer at the Buffalo district office and from 1942 as sales engineer at the corporation's Cleveland office. Laidlaw joined Worthington in 1919. For the past twelve years he has been district manager.

Mid-Continent Supply Company has announced the promotion of **C. H. Hickman** to division manager and his transfer from Odessa to Wichita Falls, Texas. Along with the transfer of Hickman, it was announced that the North Texas district has been made a division of the organization. Hickman has been with Mid-Continent since 1937. Prior to his promotion he was district manager at Odessa. Also announced was the promotion of **G. L. Huestis** of Odessa from division machinery manager to assistant division manager of the West Texas-New Mexico division. Huestis joined Mid-Continent in 1942 as field salesman at Midland. He was made chief engineer for the division in 1945 and division machinery manager in 1949.

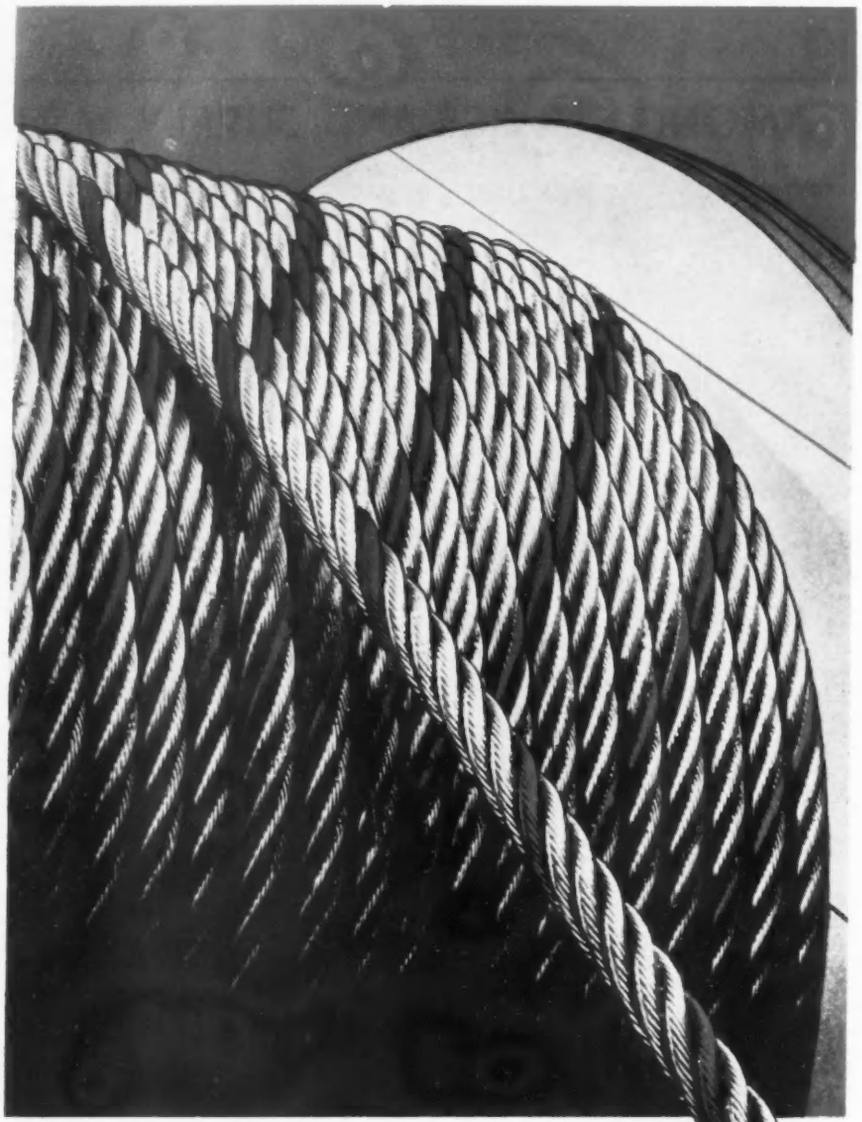
Leonard Spray of **Emsco Manufacturing Company** recently has been promoted to assistant manager of machinery sales. Starting with Emsco in 1937, he has been district manager of machinery sales in San Joaquin Valley for five years. **Vaughn A. Euge** has been named manager of machinery sales for the California division of Emsco. He began with the organization in 1933 as a helper in the Chain Shop division, joining the Sales department in 1947. In another Emsco change, **William R. Budd** has been transferred to the Houston office to handle engineering and sales of swivel joints in the Mid-Continent area. His headquarters will be at the Emsco Houston plant. For five years Budd has served the Swivel Joint and D&B division in Southern California.

Claude E. Davis has been named manager of packing and special products sales for the **Good Year Tire & Rubber Company.** He had been on special development work for the company's industrial products division at Akron, Ohio. Davis joined the firm in 1943 as a factory office squadron trainee, then joined the Belting Sales department. He was appointed field representative for the Industrial Products division in 1949, returning to Akron in 1952. **Web Wilson Oil Tools, Inc.** has announced the appointment of **William H. (Bill) Masterson** as district sales manager at Midland, Texas. He previously was with a drilling contractor, supply company and bit manufacturer. Following a sales training course at the Los Angeles general offices and factory of Web Wilson, **Hubert L. Arrowood** was appointed district sales manager with headquarters in Tulsa. He has over 30 years experience in oil industry activities, including eight years as a drilling contractor.

G. Allen Lovell has been elected a vice president of **United States Rubber Company** and appointed general manager of its Mechanical Goods division. Formerly assistant general manager of the division, Lovell joined U. S. Rubber in 1918 as an apprentice in the Williamsport, Penn., plant.

J. M. Steffee recently was named vice president and director of purchases of **Mack Manufacturing Corporation.** He joined the company April 1 as administrative assistant to the president after serving as assistant director of purchases of Studebaker Corporation.

Dowell Incorporated has promoted **Dana G. Hefley** to assistant to the general manager in Dowell's general offices in Tulsa. He formerly headed Dowell's Technical Development department which will be combined with the Field Development department headed by **J. Keller Henderson.** Hefley joined Dowell in 1935 as a research chemist.



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C. R. Jones

John McKissick

George W. Edick

Ben L. Aldridge

C. R. Jones has been appointed manager of western Canada for **Cooper-Bessemer of Canada Ltd.** Recently elected a vice president of the company, he will be responsible for sales and service operations in the western district. He was formerly branch manager at Cooper-Bessemer's Seattle office. New branch manager at Seattle is **John McKissick** who has been in the company's engineering and sales divisions since 1941. Promotion of **George W. Edick** to branch manager of compressor and stationary engine sales in New York City also has been announced. With the company since 1945, he will have charge of centrifugal and reciprocating compressors and stationary engine applications in the domestic field throughout the New York area.

Ben L. Aldridge, recently promoted to manager of the Great Bend, Kansas, office of **Welex Jet Services, Inc.,** has been with Welex over three years, holding positions of rig man, shooter and sales engineer. He is a veteran of five years with oil service companies.

Robert A. Reynolds has been assigned to the Houston district office of **Allis-Chalmers** General Machinery division as sales representative. He was previously application engineer in the rectifier sales group at Allis-Chalmers West Allis Works.

James J. Reynolds has been named vice president—operations of **ALCO Products, Inc.** Formerly vice president of industrial relations, Reynolds will be in charge of all manufacturing, procurement and material control operations of the company, as well as employe services and industrial relations. A member of the National Labor Relations Board from 1946 to 1951, Reynolds left to become vice president of labor relations of the United States Pipe Foundry Company. He resigned in 1952 to become a management consultant, joining ALCO in 1953. He will continue to make his headquarters at ALCO's Schenectady plant. **Richard B. Fairman** has been named product manager of stationary and marine diesel engines of ALCO Products, and **John Thomas** has been named assistant to the company's vice president of engineering.

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Arthur D. Darden

Taylor Milton

C. W. Trainer

C. E. Englehart

Leroy Washburn

Jack D. Bateman

R. B. Mallett

J. T. Tucker

J. L. Helton

Don Haley

J. P. Everett

John A. Jost

Arthur D. Darden, who recently joined **Higgins, Inc.,** New Orleans, as an assistant to the president, will supervise processing of new business inquiries, preparation of bidding plans and specifications and other executive duties. With a wide background and experience in shipbuilding, Darden has been project engineer with the Newport News Shipbuilding and Dry Dock Company, chief engineer of the Welding Shipyards, Inc., sales manager for the American Shipbuilding Company and chief engineer, Tood Shipyards Corporation, Houston division.

Garrett Oil Tools, Inc. announces the appointment of **Taylor Milton** as vice president in charge of manufacturing and engineering. Formerly vice president of Walter Kidde Constructors, Inc., Milton has had extensive experience in industrial engineering, plant design and production layout.

Schlumberger Well Surveying Corporation has announced the following promotions and transfers of personnel in its field organization: **C. W. Trainer,** appointed assistant to the manager of the Northwest Texas area at Fort Worth; **C. E. (Ed) Englehart** named to replace Trainer as location manager at Hobbs; **Henry W. Valentine, Jr.,** named to replace Englehart as location manager at Williston; and **G. O. Ellis,** field engineer at Cody, named manager of the Cody district replacing Valentine.

Leroy Washburn has joined the staff of **Rawson and Company** to give inside sales assistance and handle office activities of the firm. Washburn came to Houston eight years ago and was with Maintenance Engineering Corporation until recently.

Jack D. Bateman, senior market analyst at **Rockwell Manufacturing Company,** has been named manager of market research. He succeeds **A. Clark Daugherty,** who has been assigned other corporate duties in addition to maintaining over-all supervision of market research and public relations. Bateman joined Rockwell as market analyst in 1951.

R. B. Mallett, appointed sales and service engineer for McEvoy Company, will be in charge of the company's West-Central Texas area with headquarters in Abilene. He replaces **Gil Robinson** who transferred to Calgary, Alberta, Canada as district manager. Mallett was associated with an oil tool company before joining McEvoy.

J. T. Tucker, general manager of sales for the George E. Failing Company, has been named vice president of the **George E. Failing Supply Company, Ltd.,** of Edmonton, Alberta, Canada. He will continue to maintain offices in Enid, Okla. **J. L. (Jimmy) Helton** has been made general manager of the Canadian company, succeeding Harry Failing who recently resigned. Helton has been manager of the branch plant in Midland, Texas, since 1947. At Enid, **Don Haley** has been named manager of Failing's Employe Relations department. Prior to joining Failing, Haley was with Tidewater Associated Oil Company and Unit Rig and Equipment Company in personnel work.

John Porter Everett, instructor in the Department of Petroleum Engineering at the University of Kansas, has been appointed petroleum engineer for the Oil and Gas department of **The Hibernia National Bank** in New Orleans. After teaching at Oklahoma A&M College, he became associated with the University of Kansas in 1951 where his courses included drilling, production, valuation, reservoir mechanics, core analysis, lab and electrical log interpretation.

John A. Jost has joined Kewanee-Ross Corporation, Ross Heater division, as heat exchanger development engineer. He formerly was with Foster-Wheeler Corporation where he specialized in Karbate heat exchangers.

A. R. Schneller, who has been Pacific Coast sales manager for the Welding Products division of **A. O. Smith Corporation,** moves to the new position of eastern regional sales manager for the division. Before his activity on the West Coast, Schneller was in charge of welding sales in Wisconsin.

Robert F. Bourne has been appointed director of sales-national accounts for **The Colorado Fuel and Iron Corporation. Edwin F. Lord** will succeed him as general manager of sales for the Claymont Steel Products department of C F & I. Bourne joined the company in 1946 as a sales engineer. He has served also as manager of export sales and manager of Rolled Products sales for the Colorado division. Lord has been associated with Claymont since 1950. Prior to his new appointment he was sales manager of the Fabrication department.

H. A. Wiley, Jr. has been named manager, Belting and Packing Sales, **Quaker Pioneer Rubber Mills,** division of H. K. Porter Company, Inc. He formerly was associated with one of the major Eastern rubber companies in both production and sales engineering. He came to Quaker Pioneer in 1950 as a member of the Production department. In his new position, Wiley will coordinae factory and field activities of Quaker Pioneer's Belting and Packing departments.

J. W. McCormick has been appointed New York district manager of **Pacific Pumps, Inc.** With Pacific since 1941, he formerly was assisant manager of the centrifugal pump office in New York.

Dennis A. Lynch has been appointed assistant superintendent for the Bakersfield district of **Lane-Wells Company.** With the company since 1946, he was working out of the Bakersfield branch as operator and maintenance technician prior to his recent appointment.

Baker Oil Tools, Inc. announces the following personnel changes and additions in its Canadian subsidiary, **Baker Transworld, Inc.: Clifford J. Taylor,** formerly division sales engineer in the Mid-Continent division, becomes division manager with headquarters in Calgary; **Roy K. Hautzinger,** who has been active in Canadian oil industry affairs for 15 years, continues as sales representative in the Edmonton area; and **Lyall R. Thorne,** who joined Baker Transworld in February, also assumes duties of sales representative in Edmonton.

A. R. Tullos

J. T. Lewis

Kobe, Inc. Announces Changes In Hydraulic Sales Organization

Kobe, Inc. has established a new East Texas-Gulf Coast hydraulic sales division, to be headed by A. R. Tullos. With Tullos in division headquarters in Houston will be P. M. Wilson, district sales representative, who will transfer from Corpus Christi.

In separating this area from the former Southern Area Sales division, J. T. Lewis, division sales manager, has been transferred from Fort Worth to Midland where he will head the newly-created West Texas-New Mexico Sales division. S. S. McDonnold, recently promoted to district manager, will also be in Midland. In the Fort Worth office, V. L. O'Neill, district sales representative, transferred from Tulsa, will be in charge of headquarters contacts in Dallas and Fort Worth.

On the West Coast, Carl Brown, formerly manager of industrial sales in Cleveland, has been named Los Angeles Basin district sales manager for hydraulic sales. Also working out of Los Angeles, but in charge of coastal sales, is W. C. Prigge, district sales representative.

Thirty Chiksan Sales Personnel Attend Three-Day Conference

Thirty Chiksan sales personnel were present at a recent three-day sales conference held at the main office and plant at Brea, Calif., under the direction of G. R. Winder, vice president and general sales manager.

Chiksan's newest products, including a mechanized dock hose, a completely integrated self-propelled 8-inch aluminum hose designed to eliminate manhandling of rubber hoses in marine petroleum loading, were unveiled and demonstrated. The mechanized hose utilizes a hydraulic system powered by electric motor. Another Chiksan product shown to many for the first time was a hydraulic monitor operated by water pressure from remote controls.

The meetings were conducted by R. T. Jones, western regional sales manager, and L. J. Smith, eastern regional sales manager.

Calumet & Hecla Canadian Firm To Be Subsidiary of Wolverine

Calumet & Hecla, Inc., has announced acquisition of all outstanding shares of Canada Vulcanizer & Equipment Company, Ltd. of London, Ontario. The Canadian concern will operate as a wholly-owned subsidiary of Calumet & Hecla's Wolverine Tube division in Detroit. D. D. C. McGeachy will continue as president and general manager of the firm.

The new subsidiary manufactures Wolverine patented fiinned tubing and builds heat transfer equipment incorporating the tubing. It is also a leading Canadian manufacturer of vulcanizing equipment.

Pioneer Specialties Names Five Area Representatives

Five new representatives have been named by Pioneer Specialties, Inc. in the West, Southwest, Midwest and in the North Central states.

In California, George Kerbo, Long Beach, and L. O. Montgomery, Bakersfield, have been appointed joint agents. Warehouse stocks will be maintained in Long Beach, Ventura and Bakersfield to supplement supply store stocks.

Southern Oklahoma has been added to Pioneer Specialties' territory with Lee Franks, Wichita Falls, Texas., as representative. A company warehouse for Pioneer stocks has been established at Lindsay, Okla. to service the new area. There is also a warehouse at Wichita Falls.

The Kansas and northern Oklahoma area is represented by W. W. (Woody) Coonrod with headquarters and warehouse stock at Great Bend, Kansas. James O. Gravitt, Mt. Vernon, Ill., will handle sales and service in the North Central states. Field emergency stocks will be warehoused at Mt. Vernon.

T. A. McKenzie to Head Homco Canadian Office

Thomas A. McKenzie will head a new directional drilling and oil well surveying office opened in Calgary, Alberta, Canada by Houston Oil Field Material Company. Prior to joining Homco, McKenzie was general manager for Eastman Oil Well Surveying Company, Ltd. in Calgary.

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linings are applied only by Tube-Kote

—and only TK-2 has been applied on more than 12,000,000* feet of pipe!

*This is equivalent to 2,500 oil wells 5,000 feet deep. In actual use, many companies have the upper 2,000 feet coated to protect against paraffin — others line entire strings up to 12,000 feet or more with TK-2 to protect against corrosion.

If you want to learn the real facts about plastic linings write for information about TK-2 — it's an exclusive, thermo-bonded plastic applied on pipe used in scores of major oil fields in this country and overseas. **Write today— get the facts.**

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Manufacturers-extruders of plastic pipe for the oil industry.
Factory-trained, field engineers available for consultation in all principal oil areas.

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(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

LeGrand Opens Canadian Factory and Warehouse

Above is the new factory and warehouse of LeGrand Limited in Calgary, Canada. Under the direction of S. C. Cook (left), vice president and general manager, and D. J. Elcome (right), chief engineer, LeGrand Limited will serve the oil fields of Western Canada as distribution and factory service agency for beam pumping units and other equipment manufactured by the parent company, LeGrand, Sutcliff and Gell Ltd. of Rochester, Kent, England, and for the hydraulic pumping units of the S. C. Carter Company, Inc., of Los Angeles.

General Geophysical of Houston Moves Headquarters Offices

General Geophysical Company, Houston, has moved headquarters offices to Suite 750 in the new Houston Club building. General has maintained offices in the Gulf building since 1936. The new offices contain 4100 square feet of space and will house executive, accounting and drafting offices.

McCullough Tool Opens Two Western Branch Offices

The McCullough Tool Company has opened new branches at Grand Junction, Colorado and at Westhope, N. D., to furnish 24 hour service to the oil industry.

P. D. Vollum has been appointed manager of the Westhope branch, transferring from Williston, N. D. Vollum has had extensive field experience with McCullough and with Halliburton Oil Well Cementing Company.

V. J. Sanders, formerly manager of McCullough's Newcastle branch has been transferred to Grand Junction as branch manager. He has been replaced at Newcastle by William Morley, former line truck operator at Newcastle. Morley's previous experience was with Johnson Testers and Fred Manning in the Rocky Mountain area.

B-I-F Industries Expands Sales, Service in Midwest

B-I-F Industries, Inc., has announced a new expansion program in the Chicago district, highlighted by formation of two new B-I-F offices and addition of factory-trained personnel.

M. H. Strickland has been appointed manager of industrial sales for the Chicago district which will now handle the complete industrial line of equipment for Proportioneers, Inc., manufacturers of chemical feeders and automatic blenders.

A new office at Milwaukee, is headed by Harold D. Bugg, while another new office in Indianapolis is managed by Byron Anderson. In Minneapolis Thomas Voegtli has been added to the Sales-Service department.

Operation "Expert" Begins for Hawthorne Bits

A shipment of 2000 Hawthorne "Blue Demon" rock bits begin their journey halfway around the world. The 6½-ton shipment takes up little space in the freighter being loaded at the Houston docks, but it represents nine months of shot hole drilling to an oil-finding crew operating in the Persian Gulf.

Pacific Pumps Establishes Philadelphia Sales Office

J. J. Coffey, formerly sales engineer in New York, has been appointed manager of the new district office in Philadelphia of Pacific Pumps, Inc. Located at 1612 Market Street, the office will handle sales of Pacific centrifugal pumps in southern New Jersey, Pennsylvania, Delaware, West Virginia, Maryland, Virginia and Washington, D. C.

Leschen Wire Rope Moves Office to Newark

The New York district office and warehouse of Leschen Wire Rope division, H. K. Porter Company, Inc., has been moved to 219 Emmet Street, Newark, N. J.

In addition to providing increased space for warehouse and shipping facilities, the new location is convenient to metropolitan New York via the Pulaski Skyway system, and is within five blocks of the New Jersey turnpike.

Youngstown Sheet and Tube Announces New Tube Mill

The Youngstown Sheet and Tube Company announces plans to build a seamless tube mill at the Indiana Harbor Works in the Chicago district. Pipe produced will range from 4½ to 9⅝-inch outside diameter.

Present tubular facilities in the Chicago area include two continuous butt weld pipe mills, an electric weld mechanical tubing mill and a conduit department.

New seamless facilities will consist of two main buildings 2000 feet long, located north of the new blooming mill and open hearth department. Each of the buildings will house both hot working and complete finishing and heat treating facilities. Features of the new seamless mill will be precision rolling and finishing equipment.

G-E Department Announces New Sales Office and Warehouse

Establishment of a new direct-sales office and warehouse in Buffalo, N. Y., has been announced by the General Electric Welding department.

W. G. Leaman, Buffalo metallurgist and welding engineer has been named manager of the new office, located at 701 Seneca Street. It is the regional outlet for the complete line of G-E equipment, electrodes and accessories.

B J Service, Inc., Opens New California Research Lab

A new and completely-equipped engineering development and testing laboratory building was officially opened June 23 at the Long Beach, Calif., headquarters of B J Service, Inc. The new 5000-square foot building houses engineering and development offices, a pumping process laboratory and a wire line model shop. All are under supervision of Matt Riordan, vice president in charge of engineering and development.

B J Service chemical and hydraulic specialists will use the laboratory for evaluation of techniques for hydraulic fracturing. They also will concentrate on evaluating data relative to compressive strengths and thickening times of oil well cements. In chemical research, the laboratory will be used for testing new innovations in oil well acidizing and well stimulation.

Jones Company Names Ideco Export Representative

The S. M. Jones Company announces the appointment of Ideco, Division of Dresser Equipment Company, as exclusive export representatives for Jones sucker rods and related products. Ideco's headquarters are in the Republic National Bank building, Dallas, with their Export Sales division located at 800 Channin building, New York.

Bown Appointed Manager Of New McCullough Branch

The McCullough Tool Company has opened a new service branch in Carmi, Ill., to provide complete oil tool services to the industry in the Illinois Basin.

R. B. Bown

R. B. Bown, appointed manager of the new branch office, was transferred from the McCullough Eastern division headquarters at Houston where he has served as division safety engineer. Previously he had done experimental work in the McCullough laboratories in development of jet perforating and cutting tools and had helped indoctrinate McCullough's distributors and customers in South America in the operation of McCullough's wire line services.

Wolverine Tube Expands Sales District Facilities

New mill depot facilities and a branch office of the East Central Sales district have been opened by Wolverine Tube, division of Calumet & Hecla, Inc.

The new mill depot, a modern building with 16,800 square feet of floor area, is located at 8941 Schaefer Highway in Detroit. Complete inventories of copper water tube, refrigeration tube, automotive tube and S. P. S. red brass pipe, in every size, will be maintained, enabling Wolverine to make shipment within 24 hours after an order is received.

Higgins Delivers Captain Jack To U. S. Corps of Engineers

The latest survey boat for the Corps of Engineers, the Captain Jack, was delivered recently by Higgins, Inc., New Orleans. A 52-foot steel vessel, her beam amidships is 15 feet, 7½ inches; her maximum draft, loaded, 3 feet, 10 inches. Designed to make 22 mph loaded, she cruises at 18 mph. She has a forward cabin, a bridge house with engine compartment below and an after cabin. The forward cabin accommodates six persons, including sleeping quarters. Captain Jack is provided with the latest type communications, depth finding and radar equipment.

National Supply Company Moves London Headquarters

The London, England, offices of The National Supply Company have been moved into new and larger premises at City Wall House, Chiswell Street, London, E. C. 1. The London branch, managed by Richard B. Rogers, takes care of company sales in England and various European and Eastern countries. It was established in 1921.

In many areas . . .

Operators are finding that DIAMONDS REDUCE CORING AND DRILLING COSTS

FORMATION BIT SIZE	TOTAL FOOTAGE	PENE-TRATION RATE	NET BIT COST	BIT COST PER FOOT	DRILLING CONDITIONS BIT LOAD POUNDS	RPM	FL. VOL.
NORTH FOX BUSH UNIT, BUTTER COUNTY, KANSAS							
Sand, Lime Chert	496 ft.	2.6 ft./hr.	$1,188.35	**$2.40**	12,000	75	170 gpm
6⅛" x 3½" Core Bit					16,000		
WILDCAT FIELD, RIO BLANCO COUNTY, COLORADO							
Sand (Fractured)	694 ft.	2.7 ft./hr.	$1,004.73	**$1.55**	8,000	60-65	380 gpm
and Shale					18,000		
8⅝" x 4" Core Bit							
BISTENAU FIELD, WEBSTER PARISH, LOUISIANA							
Limestone	456 ft.	2.8 ft./hr.	$1,436.57	**$3.15**	6,000	90-100	120 gpm
4¾" Drilling Bit							
SOUTH COAL CREEK FIELD, NATRONA COUNTY, WYOMING							
Sundance Red Beds	760 ft.	3 ft./hr.	$ 750.08	**$ .99**	5,000	120	100 gpm
4 11/16" Drilling Bit					6,000		

Christensen's now offer diamond core and drill bits on a rental basis. For information and price per foot rental costs contact the sales and service office nearest you.

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

GOING PLACES *underground with Cities Service...*

Cities Service transported more oil through more miles of pipeline in 1954 than ever before in Company history. Reason for this bustling underground activity—more Cities Service customers than ever before in Company history!

CITIES SERVICE

A Growth Company

Number 11 of a series

WORLD OIL'S Trading Post CLASSIFIED ADVERTISING

RATES: **Regular Classified** (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted ads,** 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

HELP WANTED

■ MECHANICAL ENGINEERS. A medium sized leading manufacturer of oil field equipment and gray iron castings now needs additional engineers for product development and design work. Experience in similar or related work would be favored. All replies confidential. Write stating full qualifications and salary requirements to Box 64-W, c/o The World Oil, P. O. Box 2608, Houston, Texas.

DESIGN ENGINEERS

Well established, progressive Company expanding its Houston Texas manufacturing facilities requires additional design engineers. Experience in design and development of oil well drilling tools and equipment would be favored. This is not just another job. If you have ability and can think, opportunity exists. Send complete information and salary requirements. Confidential.
Box 63-W, c/o World Oil, Houston, Texas.

PETROLEUM ENGINEERING GRADUATE

Preferably with some oil field experience in the Southwest who may be interested in reservoir study, pressure maintenance, water flooding, gas repressuring, field supervision, core analysis, and appraisal work in conjunction with our small well established consulting petroleum engineering firm in North Texas. Adequate compensation with advancement. Include personal data, snap shot, oil field experience, scholastic standing, when available, marital status, draft or service prospect, etc. in your letter to Box 68-W c/o World Oil.

■ Field Salesman. To sell Geophysical and related supplies in Oklahoma area. Applicant must have previous sales experience, preferably in Geophysical items. Generous compensation plan, plus car and all expenses. State age, education, experience and marital status. Box 70-W c/o World Oil, Houston, Texas.

BUSINESS SERVICE

■ Delaware Corporations formed and serviced. Inquire without obligation. American Guaranty & Trust Company, 910 West Street, Wilmington, Delaware.

HELP WANTED

Production Research

A decision to expand markedly drilling and production research activities at THE RESEARCH CENTER OF THE GULF OIL CORPORATION creates excellent opportunities for B.S. THROUGH Ph.D. GRADUATES IN:

PHYSICS
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PETROLEUM ENGINEERING
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Experience in the problems of production research or field operations while desirable is not essential.

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Write to:

Gulf Research & Development Company

P. O. Drawer 2038
Pittsburgh 30, Pa.

POSITIONS WANTED

■ Graduate Petroleum Engineer, 24, Canadian University, Canadian Citizen, 3 years drilling, production, field and office experience in Canada. Desires position with MAJOR or LARGE INDEPENDENT oil concern in South America. Box 66-W, World Oil, Houston, Texas.

■ Reservoir Engineer and Logging Expert, 35, married, with seven years' experience in field engineering and all phases of reservoir engineering with one major company. Currently employed as reservoir engineer in key position. Desires responsible staff position with opportunity for advancement. Box 67-W, World Oil, Houston, Texas.

NOTICE

■ Anyone knowing the whereabouts of Earl Clifton Nance, an oil field worker, please contact Box 69-W c/o World Oil, Houston, Texas.

WANTED

■ Substantial Oil company desires to purchase oil or gas producing property or oil and gas company with production. Interested in minimum of 100 barrels of oil per day. Will trade on stock, cash or merger basis. Contact E. J. Evans, First California Company, 647 S. Spring Str., Los Angeles, Calif.

FOR SALE

FOR SALE PRODUCTION

Fractional working interests in 41 producing leases, Southern Illinois, 93 wells. Offers subject to court approval. For information white Charles O. Parvin, Executor, Estate of Thomas S. Doran, Box 151, Vandalia, Illinois.

BUSINESS OPPORTUNITIES

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

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P. O. Box 1628 — Hobbs, New Mexico — Phone 3-3141
146 Allen Building — Midland, Texas — Phone 2-2962

MISCELLANEOUS

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Our organization can obtain oil concessions, farmouts, join in the financing of oil developments, handle all Government, corporate, legal, fiscal, banking, accounting, labor, and all local matters relating to the oil industry.

Solicit our report on oil possibilities in Cuba

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Cable address: PETROLEROS, HAVANA

■ JAMESON STRAW FIELD, COKE COUNTY, TEXAS. Complete Oil Production History. Seven million barrels, monthly reports. Helen Marshall, Oil Reports, 2217 Dallas Street, San Angelo, Texas.

■ OIL AND URANIUM LOCATING SERVICE. Worthwhile properties. Approximate depth of oil and minerals determined. Drilling locations pinpointed. Documentary proof of success. Young and Critchlow, 1975 N. W. Everett, Portland, Oregon.

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MOTORS

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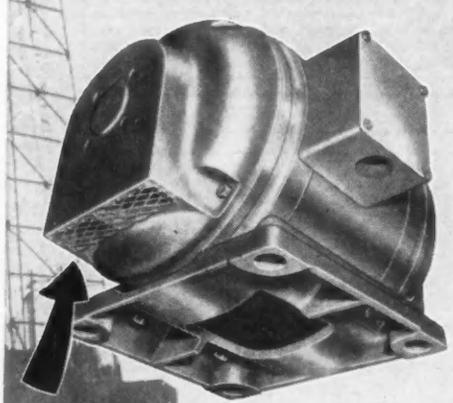
For example — heavy cast base assures alignment stability . . . heavy-duty, double-shielded, pre-lubricated bearings increase performance, reduce lubrication problems . . . high-grade silicon steel in the magnetic circuit reduces iron losses . . . wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems . . . high slip is available to take care of reciprocating load requirements encountered in pumping.

The FIELDMASTER has many other **outstanding advantages** that our distributor, the BETHLEHEM SUPPLY COMPANY, will be happy to show you. May we have them contact you **. . . without obligation?**



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Distributor, BETHLEHEM SUPPLY CO., TULSA, OKLA.

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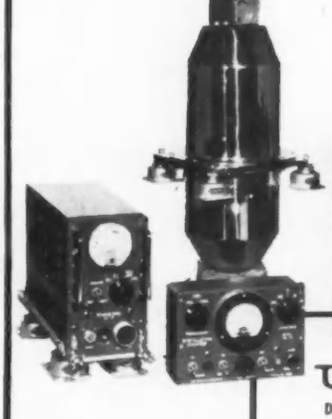
STABILITY *NOT* **DRIFT**

Exterior compensating controls to offset electrical drift. A series of 5" x 8" crystals to fit your utmost sensitivity requirements. From $2990. to $8745.



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Dresser Appoints Director For Overseas Operations

World-wide expansion of Dresser Industries, Inc., its various operating companies and foreign subsidiaries and appointment of a foreign director to set up and direct an expanded overseas operations department has been announced by the company.

Reece Hatchitt

This announcement followed a recent meeting of the executive staff of Dresser Industries and its subsidiary companies engaged in foreign and export work to review world markets and program operations plans for Dresser's expansion in the foreign field.

As director of these expanded operations, Dresser has named Reece Hatchitt who formerly handled company foreign legal affairs. He has been engaged in foreign and export work for 15 years and was formerly associated with American and Foreign Power Company operations in Latin America and the Foreign Economic Administration in Chile.

Fisher Governor Acquires Thermo Instruments Company

Fisher Governor Company of Marshalltown, Iowa, has acquired the assets of Thermo Instruments Company Belmont, Calif., manufacturers of capacitance probe type liquid level measurement instruments. D. M. Comb, former president of Thermo, is now associated with Fisher Governor in Marshalltown.

Schlumberger Establishes Two New Field Locations

Schlumberger Well Surveying Corporation has opened two new field locations to serve the Rocky Mountain area.

Offices have been opened at Grand Junction, Colo., under direction of John Rusen. Rusen was transferred from the Vernal, Utah, location which has been closed. At Rock Springs, Wyo., operations have been started with R. E. Kudrle in charge. He was formerly a field engineer at Casper, Wyo.

New Lane-Wells Willows Branch To Service Northern California

To serve the needs of the northern California fields because of mounting activity in the Glenn County area, the Lane-Wells Company has opened a new branch in Willows which is equipped to provide perforating service and well logging service on the 24-hour-day basis. The new branch is under the direction of Carl J. Niebuhr, Jr., with William V. Stratton on the staff.

Three New Bulk Storage Plants Opened by Oil Base on Coast

To expand distribution of Black Magic oil base drilling fluid, Supermix and chemical additives, Oil Base, Inc., has established three new bulk storage plants in the Gulf Coast area at Alice, Texas, Lafayette and Harvey, La. Vacuum and tanker trucks are available from these points for delivery of drilling fluids in premixed form to rigsite on a 24-hour schedule.

New Books, Maps and Movies

PETROLEUM AND NATURAL GAS PERMIT MAP OF SASKATCHEWAN, Saskatchewan Department of Mineral Resources, Administration Building, Regina, Sask. $5 for colored map; $3.50 for black and white.

This latest permit map illustrates in eight color designs the 27 separate permit holders in Saskatchewan, as well as a total of 194 permits. The map is 54 inches by 35 inches, with a scale of 12 miles to the inch.

Below the map area is a listing of all permit numbers, size and dates, as well as holders of permits.

•

BARREL NUMBER ONE, American Petroleum Institute, 50 W. 50th Street, New York 20. $60 for 16 millimeter film; $125 for 35 millimeter.

This motion picture, the API production for 1955, dramatizes the search for oil from the hazards and difficulties of discovery and production to the first barrel of oil from a new well. In sequence fashion, the oil is followed through pipe lines to the refinery and on to distribution centers. The story line is told by various people who work in oil, with emphasis placed on the many talents, trades and types of people required by the oil industry.

The film is 29 minutes long and is in black and white. Sales prints, for company showings, will be available in August. Prints for public showings will be released at the beginning of Oil Progress Week in October.

•

GEOGRAPHICAL RECORD, Petroleum Information, P. O. Box 2612, Denver. $7.50.

A compilation of material presented at the 1955 meeting of the Rocky Mountain section of the American Association of Petroleum Geologists, the book provides a handy reference to specific Rocky Mountain subjects.

A general analysis of Rocky Mountain exploration, discussions of Beaver Lodge and Tioga fields in North Dakota, of Pine field in Montana, Beaver Creek in Wyoming and Dakota sandstone sedimentation and stratigraphy in the San Juan Basin are a few of the subjects discussed in the volume. Only a few specialized papers presented at the section meeting were not released for publication.

•

SECONDARY RECOVERY OPERATIONS IN ARKANSAS DURING 1953, SECONDARY RECOVERY OPERATIONS IN OKLAHOMA DURING 1953 and SECONDARY RECOVERY OPERATIONS IN WEST VIRGINIA TO JANUARY 1, 1954, Interstate Oil Compact Commission, Box 3127, Oklahoma City.

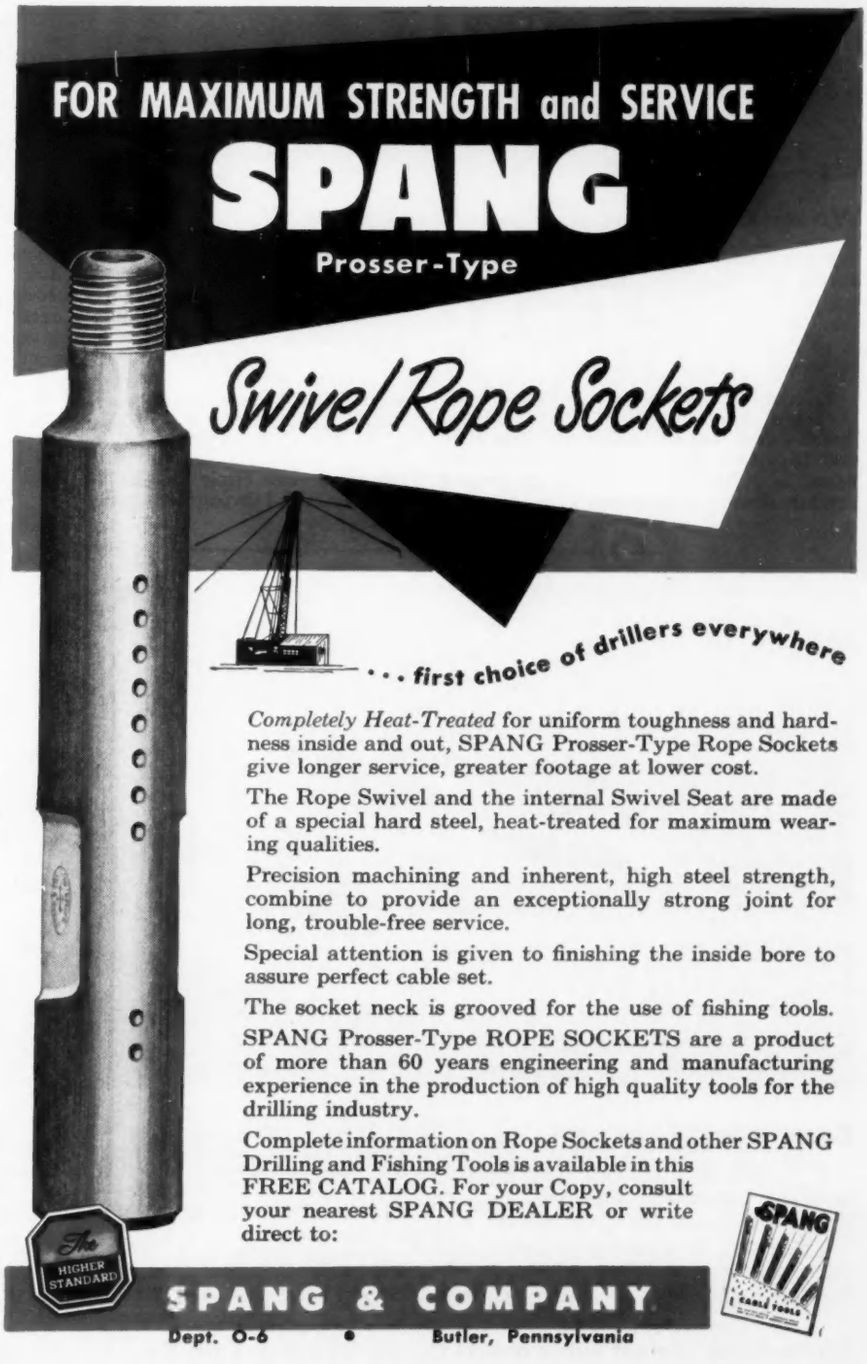
The publication covering secondary recovery operations in Arkansas during 1953 is a report prepared by the Arkansas Secondary Recovery Committee, Walter L. Dobie, chairman. The report covers 15 fields in which secondary recovery operations were carried on during 1953.

The report covering operations in Oklahoma was prepared under the supervision and with the cooperation of a Secondary Recovery Committee from Oklahoma. Massena B. Murray was chairman. Data on 154 projects are reported with a total production of 7,976,715 barrels during 1953.

The publication in regard to West Virginia operations is a report prepared by the West Virginia Secondary Recovery Committee, Alvah J. W. Headlee, chairman. It includes details on 46 gas injection projects and four water flood injection projects. In addition to information on secondary recovery operations, a report prepared by the Secondary Recovery Committee on petroleum reserves, oil in place and saturations in West Virginia is included.

FIELD CONFERENCE GUIDEBOOK, Four Corners Geological Society, P. O. Box 1121, Durango, Colo. $7.50.

Geologists working in the area have contributed 25 papers covering the oil, gas and uranium problems and possibilities in the Four Corners area of Colorado, Utah, Arizona and New Mexico to make up the Four Corners Geological Society's first field conference guidebook. Road log covers 521 miles. Approximately 100 maps, cross-sections and charts are also included in this new permanent-bound book.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Precision machining and inherent, high steel strength, combine to provide an exceptionally strong joint for long, trouble-free service.
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SPANG Prosser-Type ROPE SOCKETS are a product of more than 60 years engineering and manufacturing experience in the production of high quality tools for the drilling industry.
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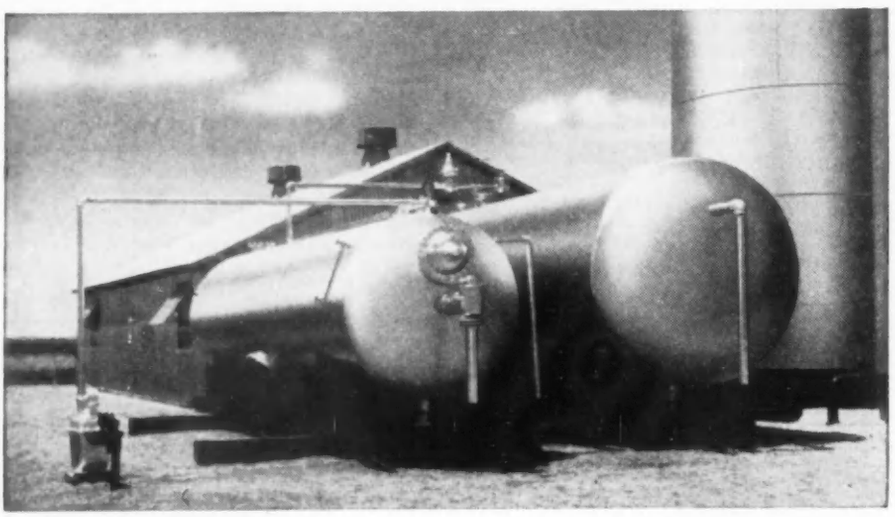


Water Conditioner

Black, Sivalls & Bryson, Inc., have introduced their new Aqua-Kleener for conditioning oil field water for subsurface injection, offshore disposal or surface disposal. A process of settling and filtering removes oil traces and solids from the water.

Equipment consists of four vessels—oil skimmers, filters, backwash tanks and the BS&B Filta-wash which combines the filter and backwash tank into one vessel. Each vessel is utilized separately or in various combinations depending on type of application and degree of water treatment required.

The Aqua-Kleener is a closed type system which reduces precipitation due to oxidation of iron, minimizes corrosion, holds carbon dioxide in solution, retards aerobic bacteria growth, and in most cases eliminates need for chemical treatment of the water.

(This item supplements Black, Sivalls & Bryson, Inc. data on Pages 657-696 of the Composite Catalog, 20th Edition.)

For more data circle **No. E1** on Readers' Service Card, last page this issue.

Crew Boat

A 51-foot, all-steel crew boat, built by Equitable Equipment Company, Inc. for Robin Boat Rental Service of Harvey, La., can be used to transport personnel and light supplies to and from oil rigs on offshore locations. Built in accordance with American Bureau of shipping standards and the U. S. Coast Guard requirements for carrying passengers for hire, they have a certified capacity of 32 passengers and can carry 40 passengers without difficulty or crowding.

For more data circle **No. E2** on Readers' Service Card, last page this issue.

Fire-Fighting Trailer

Henry H. Paris Distributor, Inc., has announced production of a completely self-contained fire-fighting trailer which carries 360 gallons of water. The 4-foot by 8-foot by 18-inch steel body has four wheels, mounted on two level load axles. Mounted on top of the trailer body are a high volume, high pressure pump, hose reel, 100 feet of one-inch high pressure hose, 150-pound dry chemical tank with 50 feet of hose, a 30-pound hand extinguisher, valves and all controls. Thirty feet of 2½-inch suction hose is carried in a special compartment at the rear of the trailer.

When drawing water from the tank, the pump will throw a stream 100 feet through the one-inch hose at 80 pounds pressure. The dry chemical tank is pivot-mounted and can be raised to an upright position and latched in place for refilling. With the valve and piping arrangement, water can be picked up from a pond, reservoir, roadside ditch or stream or directly from a fire hydrant. Water also can be taken from the sources to refill the trailer tank.

For more data circle **No. E3** on Readers' Service Card, last page this issue.

Oil Well Atom Smasher

With two tools developed by McCullough Tool Company, the neutron generator and the scintillation spectrometer, it is possible to determine mineral content of earth formations surrounding well bore, core hole, shaft or tunnel. The two see through steel casing, fluid and cement and many feet farther out into the formation than ever before, telling nature and quantity of elements in the formation.

The neutron generator, a new heavy particle generator and accelerator instrument, the first ever developed and used for elemental mineral exploration in a well bore, generates 14 million electron volt neutrons and accelerates them to over 150 million feet per second.

In operation, it is lowered into the well bore on the electric conductor cable from a service truck. Within the generator, heavy particles are accelerated to produce high energy neutrons which penetrate deep into surrounding earth formations. The neutrons react with the various atoms present in the formations producing many products and reactions which are detected by the scintillation spectrometer. Neutrons are not generated until the instrument is actuated from the surface. When power is off, neutrons are not generated.

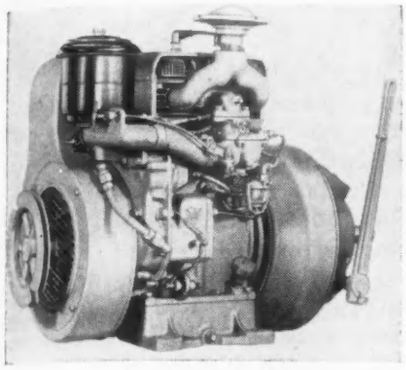
Besides being able to generate a steady stream of high velocity deep-penetrating neutrons for usual radioactivity exploration work, bursts of neutrons can be sent out and the short-lived effects on the formation can be read.

(This item supplements McCullough Tool Company data on pages 3093-3132 of the Composite Catalog, 20th Edition.)

For more data circle **No. E4** on Readers' Service Card, last page this issue.

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

NEW EQUIPMENT . . .



Oil Well Pumping Engine

A new engine, designed especially to meet variable load fluctuations encountered in oil well pumping, has been announced by Wisconsin Motor Corporation. The prime requisite to meet this condition, to provide a built-in High Momentum Factor, has been accomplished through use of multiple flywheels, the standard cooling flywheel at the cranking end and an extra-heavy 80-pound flywheel at the power takeoff end of the engine. The 3¼-inch by 3¼-inch engine with 53.9 cubic inch piston displacement, delivers from 8.7 horsepower to 13.2 horespower at engine speeds ranging from 1400 to 2200 rpm.

The new engine is equipped with an over-size heavy duty dry type clutch to assure long clutch life under the shock and fluctuating load conditions. Heavy-duty features include tapered roller bearings at both ends of the crankshaft; Stellite exhaust valves and valve seat inserts; positive type valve rotators, replaceable valve guides, low oil cutoff switch and high temperature automatic safety switch. The air-cooling system is designed for efficient operation at all atmospheric temperatures at all seasons.

(This item supplements Wisconsin Motor Corporation data on Page 5193 of the Composite Catalog, 20th Edition.)

For more data circle **No. E5** on Readers' Service Card, last page this issue.

Power Pipe Threader

Quick and easy pipe threading on the job is possible with Velocity Power Tool Company's new Lawco junior portable power pipe threader.

Simple adapters and speed reducer make it possible to handle pipe from ¼-inch to 10 inches. Designed and constructed for one hand operation, the portable threader weighs 20 pounds and is 27 inches long.

To operate, the threading dies are applied to the Lawco tool, the tool positioned, a button pressed. The power unit drives the cutting dies. It is equipped with a ¾-horsepower electric motor and toggle switch to provide reversible power.

The tool can be used also as an auger, for boring post holes, driving bolts and nuts, opening valves and as a hoist for weights up to 500 pounds.

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Joe Roughneck is the guy who gets the job done in the oil industry. He may be on a rig in the oil field or directing far flung operations from a plush office . . but he knows oil . . and pipe . . and he's the backbone and the symbol of the petroleum industry.

For Joe's personal convenience . . Lone Star's completely integrated steel mill is turning out API casing, tubing and line pipe of the highest quality. Joe likes to do business with the home folks at Lone Star where the largest mill stock in the Southwest is maintained and fast delivery is routine.

Neighbor, wherever you are, specify Lone Star and we both get a good deal!

Lone Star STEEL COMPANY

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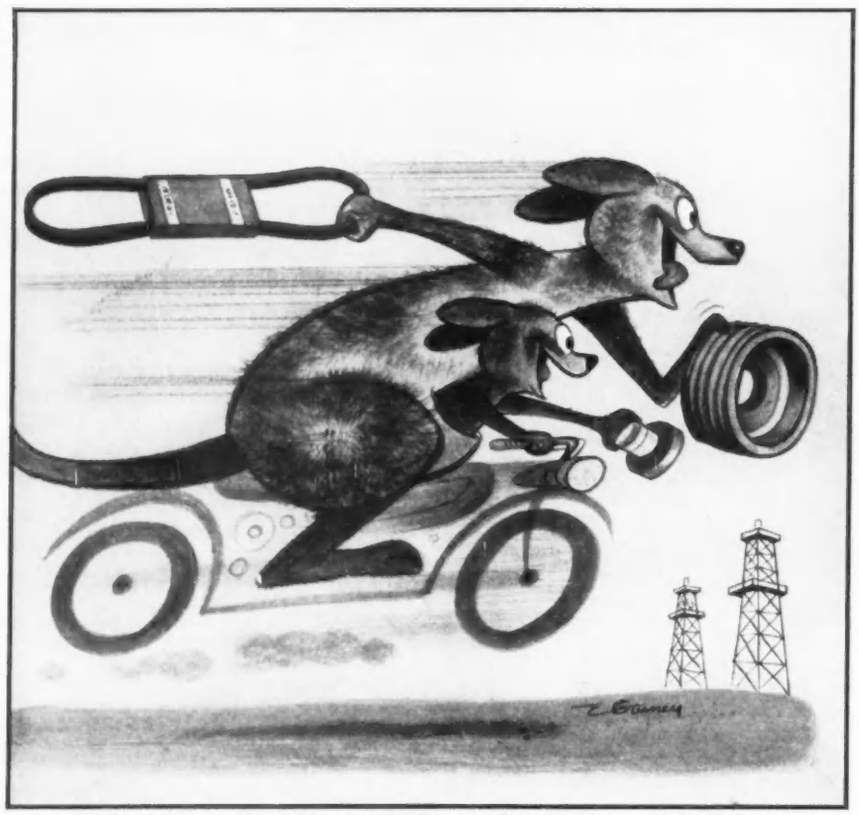

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QD, by the way, stands for Quick Detachable, which the Worthington sheave certainly is. The original two-piece sheave, it's also easy to get on and stays *tight* on the shaft.

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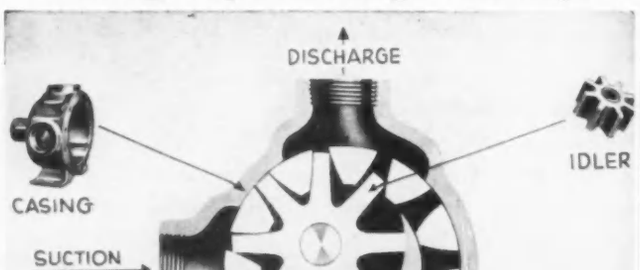

Above are illustrated the major parts of the Viking Pump—casing, head, rotor and idler, separately and assembled. Imagine the rotor and idler in motion operating in a counterclockwise direction. Follow the course of the liquid from point of suction to point of discharge. Reverse direction will operate equally well. We invite your inquiries.

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DRILLING

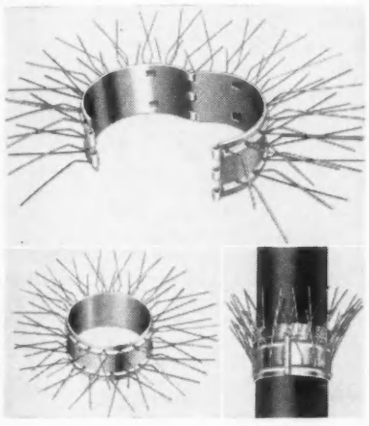
Casing Swab

An E-Z casing swab, companion to the E-Z tubing swab, has been announced by Mission Manufacturing Company. The new swab has the first casing swab rubber with controlled fluid lift. By controlling amount of fluid lift with built-in overload relief action, buying overload relief valves is eliminated.

The swab falls easily through tight spots, falls faster, eliminates junk in casing and pulls easier. It serves all swabbing needs, lowering accessory costs by eliminating need for swivels and reducing need for jars. Also, the specially-compounded rubbers give longer life.

(This item supplements Mission Manufacturing Company data on Pages 3293-3384 of the Composite Catalog, 20th Edition.)

For more data circle **No. E7** on Readers' Service Card, last page this issue.



Wall Scratcher

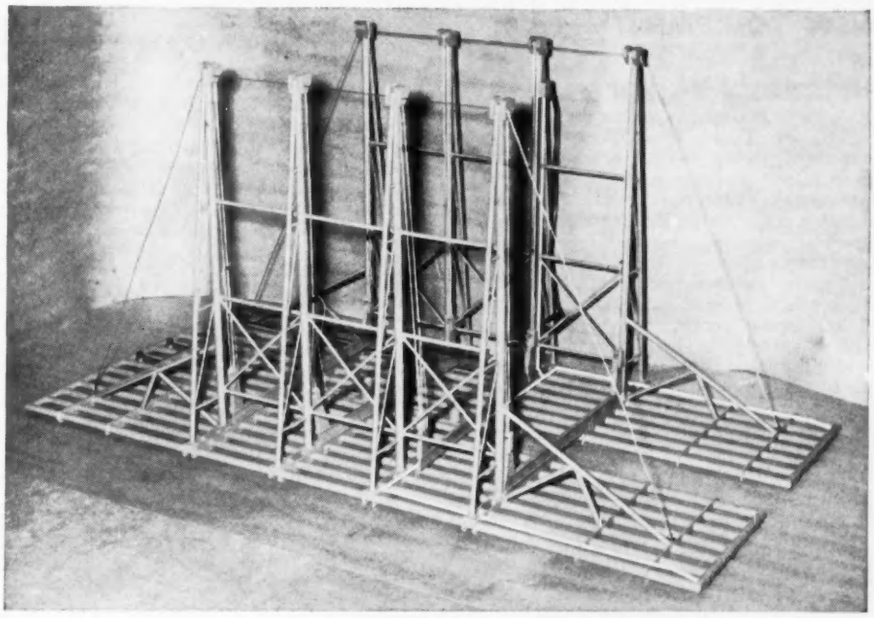
A new Baker Oil Tools, Inc. wall scratcher, furnished in either hinged or solid ring design, features exceptionally strong and rugged construction to insure maximum down-hole performance. Also, an improved design and method of mounting scratcher wires provide efficient removal of mud cake throughout the cementing area.

Wires of the scratcher become active and remove mud cake only when casing is raised during the scratching cycle. While casing is being lowered, wires remain flat against the casing leaving undisturbed the filter cake built up on sections of the hole not to be cemented. To meet requirements of all casing programs, scratcher wires are available in 2½ and 4½-inch lengths.

Shell of the scratcher is formed from two thicknesses of metal spotwelded together along the edges. This construction provides increased strength because of additional shell thickness and a resulting beam effect. The scratcher has a strong hinge construction and a new, heavier closing pin.

(This item supplements Baker Oil Tools, Inc. data on Pages 433-540 of the Composite Catalog, 20th Edition.)

For more data circle **No. E8** on Readers' Service Card, last page this issue.



Sea Raft

A new sea raft pipe structure, designed by the Sea Raft Corporation of Houston, offers many economic advantages for use in offshore drilling and production practices. This recently developed floatable pipe structure will float in 20 inches of water, yet it may be sunk and used to support a drilling barge or platform in water depths over 100 feet.

The sea raft resembles a conventional raft. It has eight platform support columns mounted on two sides, which extend upward to support a platform or barge. It is 130 feet wide and 232 feet long.

In use, the raft is towed to location and sunk by opening two valves at one end to admit water flooding. The water enters the raft uniformly and the structure settles to the bottom. There is no tendency of gliding as with a conventional flat barge as the water passes through the mat-like pipe structure as the raft sinks. No equipment is on the structure when it is being towed to location, or when it is being sunk.

When the Sea Raft has been positioned on bottom, the drilling equipment and barge is floated in between the upright columns for raising. The four sheave blocks mounted on each support column raise the lower cross beams to engage and cradle the barge. The barge unit is equipped with line shafts with winch spools on each side, which are powered by one or two motors to hoist the barge unit above the water to a desired height. Center pipe piles are lowered through the barge to engage the raft pile sockets. The piles are locked in position for additional center support. Thirty-inch pipe offset clamps are swung around under the cross beams and the barge weight is then arrested on the clamps. The barge may be suspended on lines if desired, without the use of clamps.

After the well has been drilled, the barge piling is lifted and the barge lowered back to the water. It is then towed away and the raft is ready to be raised. Air pressure is applied at the opposite end of the raft and the water is forced gradually out of the raft water valves. Buoyancy is regained and the raft is floated and moved to another location.

For more data circle **No. E9** on Readers' Service Card, last page this issue.

Consistometer

A high-pressure consistometer, a pressure chamber device for pre-determining necessary consistency of oil well cements, has been installed at Byron Jackson Service, Inc.'s Long Beach, Calif., laboratory.

The consistometer, manufactured by Refinery Supply Company under a Stanolind patent, produces pressures up to 30,000 psi and temperatures up to 400° F, equivalent to a well 25,000 feet deep. Built to conform to new API specifications for cementing wells, the consistometer is a complicated pressure-temperature chamber which puts each grade of cement through simulated well conditions and produces a complete analysis quickly.

In operation, the consistometer mixes a sample slurry of cement plus additives in a pressure chamber. The slurry mix is put in a cylindrical cup and placed in the pressure vessel. While pressure and temperature are applied, the mixture is agitated by a rotating dasher and, as the mixture begins to thicken, instruments measure increasing torque on the dasher. When torque reaches a pre-determined value, already known from given pressure and temperature, the operator knows exact thickening time of the mixture.

For more data circle **No. E10** on Readers' Service Card, last page this issue.

Water-Loss Additive

Kylo brand water-loss additive Number 27, manufactured by Minnesota Mining and Manufacturing Company from petroleum gases and designed specifically for conditioning oil well drilling fluids, is now available in dry, free-flowing flake form. As such, it is easier to handle, requires less storage space and sells at lower cost per pound of active solids than the solution form previously available. The flakes are packaged in multi-wall bags for easy addition to mud through a jet hopper.

Kylo 27 controls water loss in almost all oil well drilling fluids.

For more data circle **No. E11** on Readers' Service Card, last page this issue.

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

Hydraseal Packer

A new hydraseal packer has been designed by Texas Iron Works to permit minimum tubing weight to set the packer, as required in permanent completion well techniques. The new packer is recommended for testing single or dual zone formations, acidizing or water injection, testing casing and cement jobs, hydraulic fracturing of formations and single and dual completions.

Reinforced synthetic rubber cups permit pressure to be held from either direction, reducing tubing weight required. Ample bypass area and a solid mandrel permit circulation through and below the packer. Automatic bottom is featured to set and release the packer.

(This item supplements Texas Iron Works data on Pages 4813-4848 of the Composite Catalog, 20th Edition.)

For more data circle **No. E12** on Readers' Service Card, last page this issue.

Well Fracturing Fleet

The Western Company is now handling well fracturing assignments with new four-unit fleets, four large pieces of mobile equipment, centered around the new Western roller bearing pump. The main unit is the Fracmaster 600. The Western Master-Mixer 40 is the second member of the fleet. The third unit is the Tank-Mixer 10,000 and the fourth is the Transporter.

The Fracmaster 600 is powered by two two-cycle diesel engines delivering 600 net brake horsepower to the pump. Pump drive is direct and mechanical through 10-speed transmissions and a new high-velocity chain compound. The pump can operate at a maximum horsepower for 3000 continuous hours at 10,000 pounds per square inch. It can pump approximately 80 gallons per minute at 10,000 pounds and 37.5 gallons per minute at 2100 pounds.

The new Western Master-Mixer 40 is a complete unit, truck-mounted, featuring a completely automatic mixer. It carries a 20-barrel inventory tank. Sand is lifted to operating level by three 9-inch screw type elevators and three 750 gallons per minute vane-type pumps which inject oil into the mixing tank. A hydraulically-driven turbine-type mixer does the mixing. The unit also contains a slurry pump rated at 40 barrels per minute of sand-laden fluid.

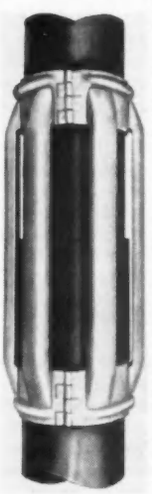
The Tank-Mixer 10,000 has a 10,500-gallon capacity and a hydraulically-driven shaft for agitation. This unit's slurry pump has a capacity of 36 barrels per minute which supercharges the treating pumps operating from either side of the mixer.

The Transporter is a unit with a sand carrying capacity of 25,000 pounds and a top emptying capacity of 5000 pounds per minute. It can be operated from ground level and from one fixed location.

For more data circle **No. E13** on Readers' Service Card, last page this issue.

Latch-On Stabilizer

The clearance between oil well casing and wall of the hole is about 1½ inches in the majority of wells drilled in active areas. In these wells a minimum thickness of 1 inch of set cement between casing and the formation will provide an effective cement seal against fluid migration.



New B and W Latch-On stabilizers are designed to hold casing away from the formation to provide this effective cement seal. The stabilizer ribs are strong and tests show resistance to side thrust and total collapse give safety factors which meet field requirements.

Casing equipped with B and W Latch-On stabilizers can be run at normal rates, because of the large effective area for returned displaced circulation. The hinged construction of the stabilizers permits the device to be mounted over the casing coupling, without welding, at the rotary table as casing is run.

(This item supplements B and W Inc. data on Pages 341-348 of the Composite Catalog, 20th Edition.)

For more data circle **No. E14** on Readers' Service Card, last page this issue.

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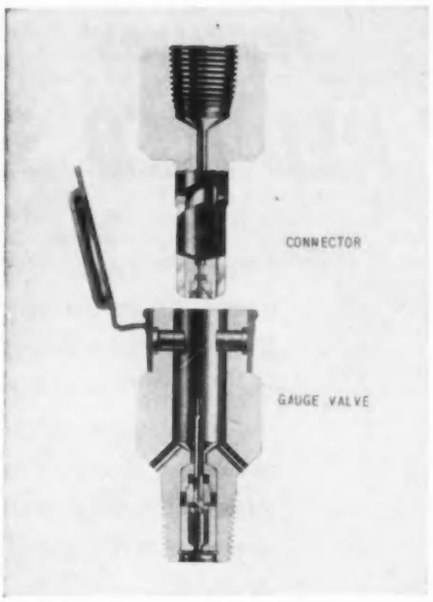
PRODUCTION



Christmas Tree Fitting

Thornhill-Craver Company has announced production of a new Christmas tree gage valve and connector. Made of stainless steel and tested to 30,000 pounds psi, the fitting was designed to eliminate need of permanently installed christmas tree gages and to permit use of a single master gage resulting in accurate and consistent pressure readings.

In operation, the upper element with J-slot is attached by threaded connection to the master gage. The lower element with built-in valve is attached to the top cap or blanking plug on the christmas tree. The lower element is installed permanently in the same manner as a pressure gage and valve are installed on a tree. A hinged cover is provided on the lower element.

(This item supplements Thornhill-Craver Company data on Pages 4849-4876 of the Composite Catalog, 20th Edition.)

For more data circle **No. E15** on Readers' Service Card, last page this issue.

Tubing Head

The Jeep tubing head, designed for safe and economical completion of low-pressure wells, is the newest addition to the wellhead product line of Gulf Coast Machine & Supply Company.

Featuring a flexibility in accordance with latest completion, repressuring, fracturing and production practices, the Jeep is the only forged steel head in its class free of welds in construction.

Designed for 1000 pounds C.W.P.—2000 pound test—it assures positive seal by means of a double packer, and carries three-piece hinged slips. It is available in 4½-inch and 5½-inch female full opening and 7-inch male not full opening for 2-inch or 2½-inch tubing, and with two 2-inch threaded outlets.

(This item supplements Gulf Coast Machine & Supply Company data on Pages 1945-1964 of the Composite Catalog, 20th Edition.)

For more data circle **No. E16** on Readers' Service Card, last page this issue.

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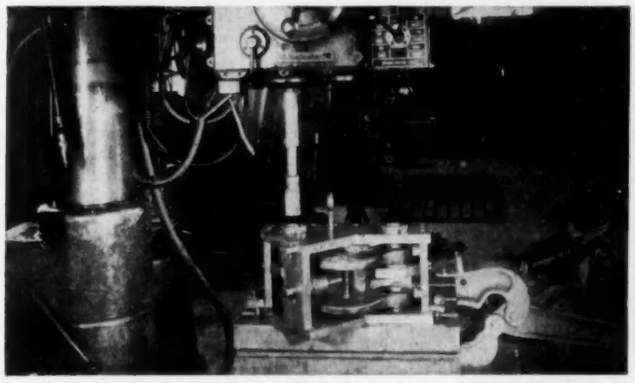

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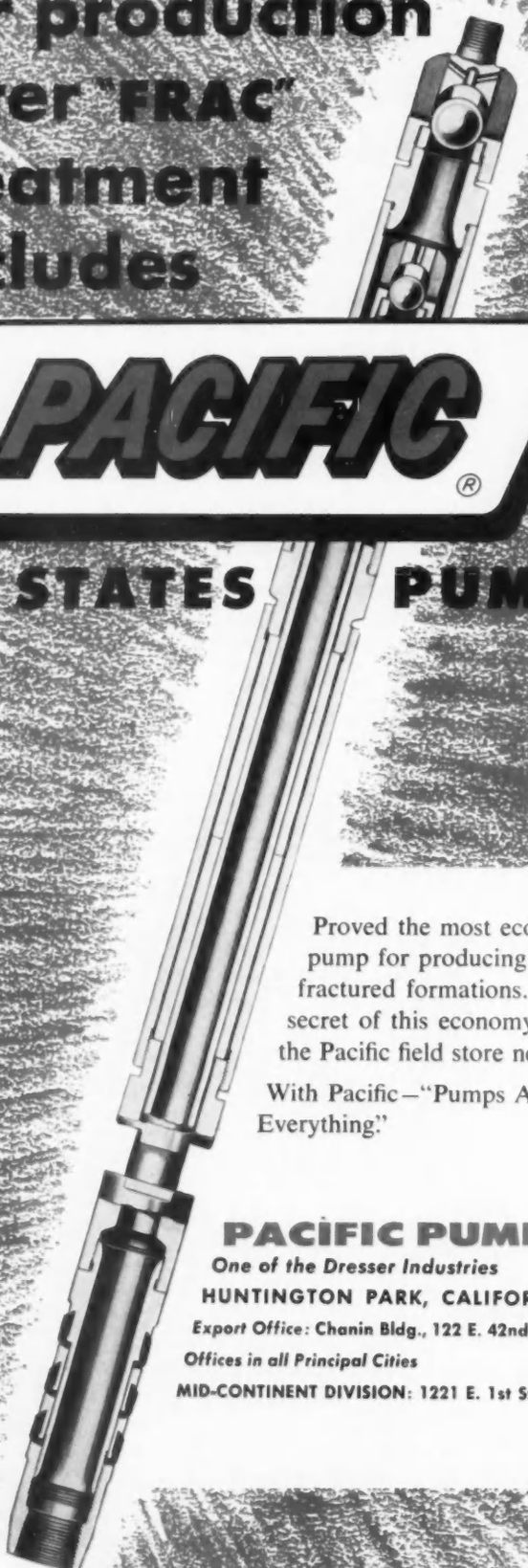

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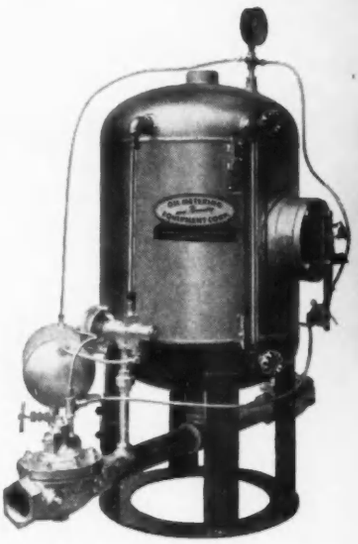
DW-13

NEW EQUIPMENT . . .



Liquid Metering Vessel

A new liquid metering vessel, recently announced by Oil Metering and Processing Equipment Corporation, employs a sensitive internal float and snap-acting pilot to obtain accuracy equal to or greater than that obtained in tank gaging. As only a few inch-ounces of torque are required to actuate the pilot, volume of fluid that is accumulated, isolated and discharged at each cycle is consistent throughout an unlimited number of cycles.

Accuracy of this float and pilot design eliminates need of Seraphin necks on the vessel and reduces cost of the meter as compared with metering vessels of comparable accuracy. The pilot is mounted externally and permits the vessel to be calibrated while in service.

For more data circle **No. E17** on Readers' Service Card, last page this issue.

Christmas Tree

A new dual string christmas tree, assuring positive control during all completion operations, has been announced by Cameron Iron Works, Inc. The new tree allows the operator to run parallel strings in the same manner as single strings, independently or simultaneously, and with the protection of the Cameron closed-pressure system of well completion.

At no time during completion operations does Cameron equipment leave the well open. A standard Cameron blowout preventer with special off-center rams provides protection during initial phase of the completion. Back pressure valves are provided to safeguard against loss of control through the tubing string.

Each tubing string is suspended, locked in the tubing head and sealed before preventers are removed. The tree may then be installed and flowline connections made before removing the back pressure valves and washing the well into production.

(This item supplements Cameron Iron Works, Inc., data on Pages 1005-1076 of the Composite Catalog, 20th Edition.)

For more data circle **No. E18** on Readers' Service Card, last page this issue.